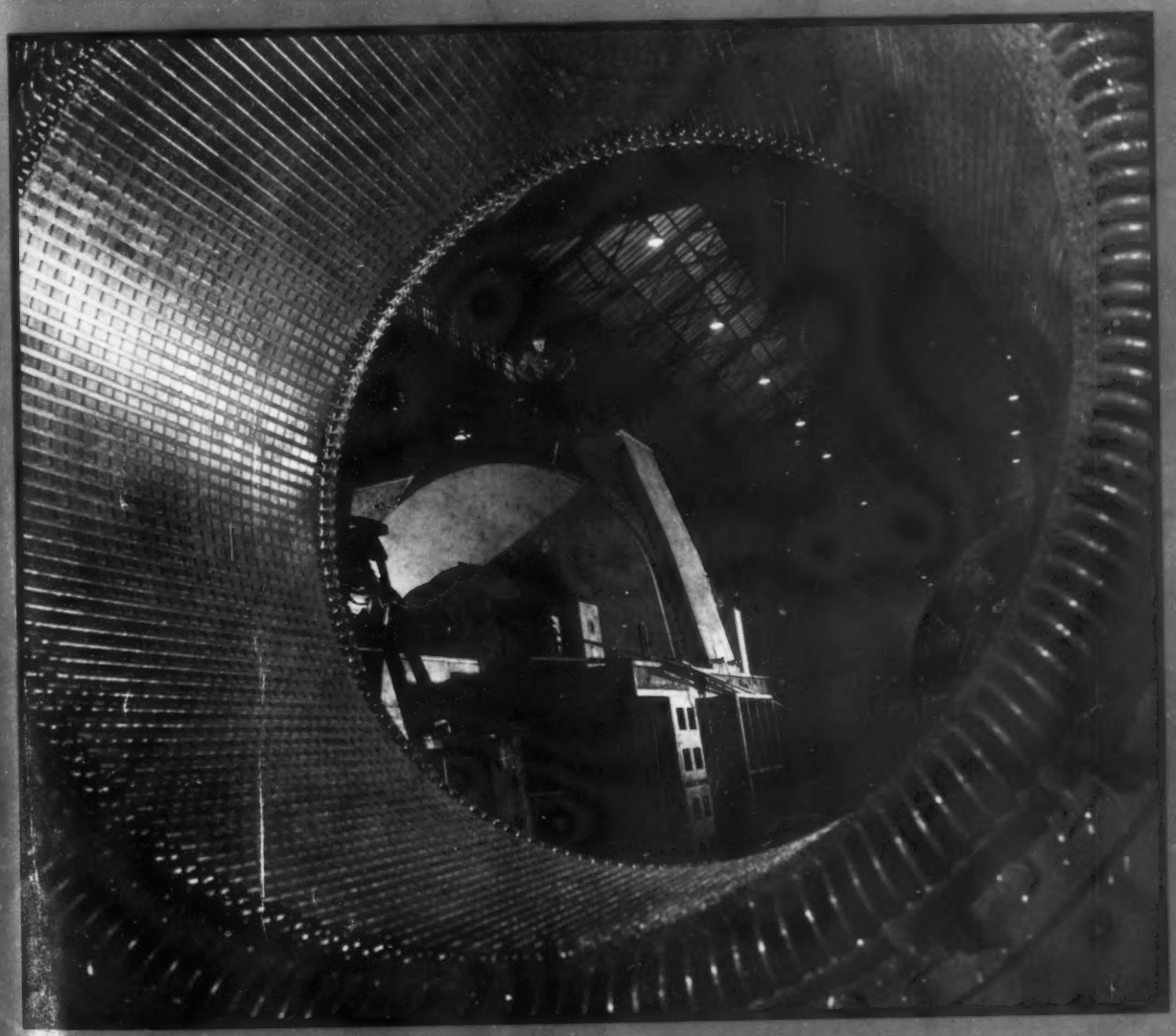
JOURNAL OF THE AERONAUTICAL SCIENCES

AERONAUTICAL REVIEW SECTION



VOLUME 9 FEBRUARY, 1942 NUMBER 4

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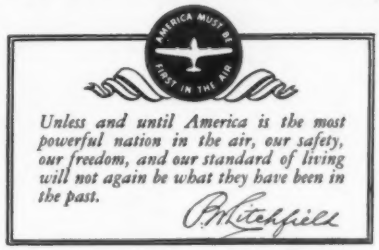

Unless and until America is the most powerful nation in the air, our safety, our freedom, and our standard of living will not again be what they have been in the past.

P. W. Litchfield

Shortly after the armistice Goodyear completed development of the first rubber-covered, bullet-puncture-sealing gasoline tank for airplanes.

During this period airplanes were becoming larger, faster and heavier. Smooth, safe landings became difficult on hard, high-pressure tires. Goodyear met this with the low-pressure type Airwheel that has since revolutionized all tire design.

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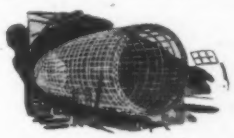

As a result of Goodyear's efforts to secure stronger, lighter alloys for airship fabrication, America today produces alloys for airplanes far superior to any known twenty years ago.

During the thirties we developed featherweight magnesium-alloy wheels for transport airplanes, and hydraulic disc brakes that pack tremendous stopping power in small compass.

Today Goodyear's great aircraft parts factories are producing complete all-metal wing and tail assemblies, nacelles, floats, ailerons, cabin structures, bullet-puncture-sealing gasoline tanks, wheels and brakes – in ever-growing torrent.

Upon this work we are devoting all the aeronautical experience and skill acquired in thirty years of pioneering, in full realization that our liberty is not secure until America commands the air.

COTTON HELPS "KEEP THEM FLYING"

For instance, in the foreground above the two pilots chatting over this morning's maneuver are wearing cotton uniforms—all their visible equipment is cotton, except for helmets and goggles. And the scout observation plane as it catapults from the battleship takes the air on wings of cotton.

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JOURNAL OF THE AERONAUTICAL SCIENCES

AERONAUTICAL REVIEW SECTION

FEBRUARY, 1942

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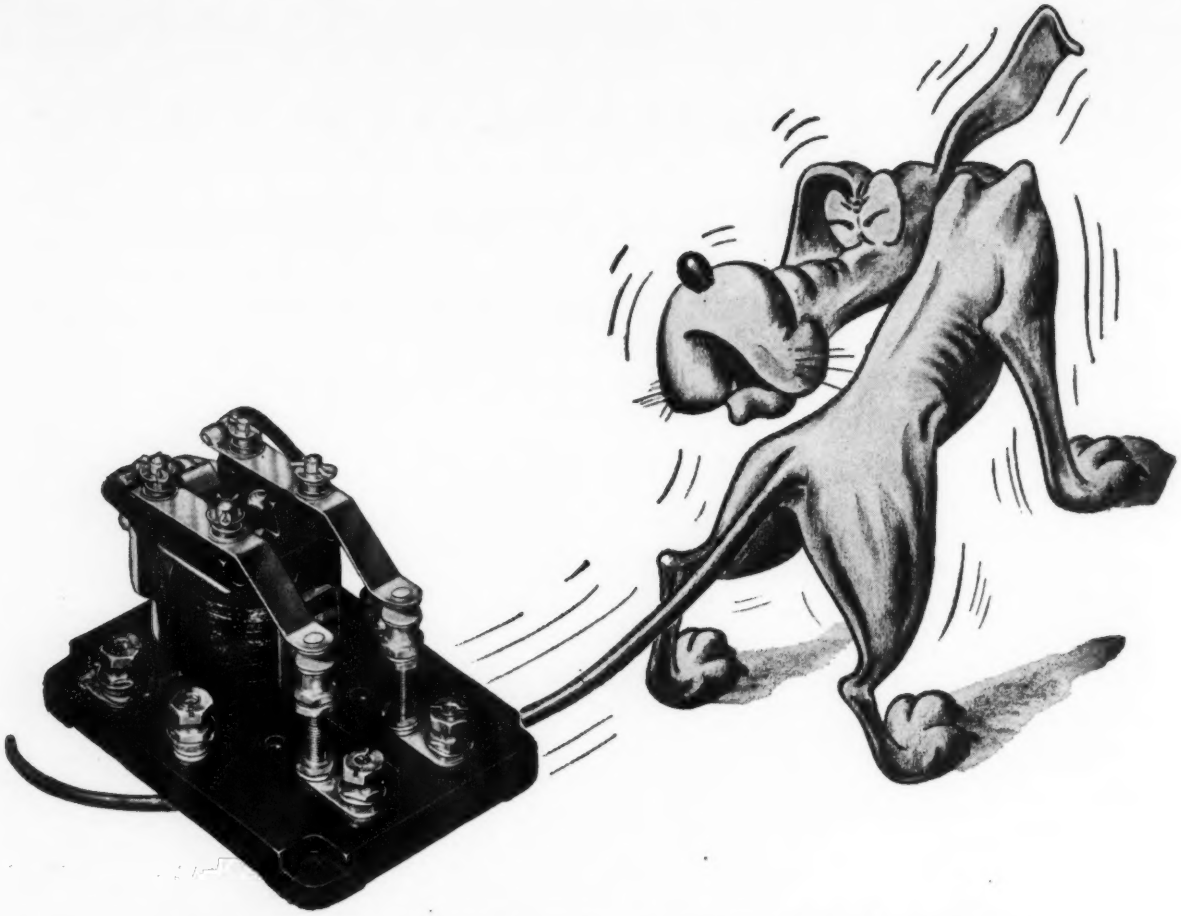

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A War Is On

THE ARRIVAL OF WAR HAS not only knocked the business-as-usual scheme of business and living into the proverbial cocked hat, but has produced an extreme need for a completely revitalized technique in business operations. Personnel, production and sales technique are having to be put on a wartime basis, geared to the restrictions as well as to the urgent and specialized needs of wartime.

But, even more urgently are business and industry called upon to get down to essentials by eliminating all dross in sales methods and by developing a vigorous interchange of technical information between producer and consumer, especially among related wartime industries which are dependent upon one another for meeting the tremendous responsibility which America's entry into the war has placed in their hands.

The trend toward more informative textual matter in business and industrial advertising is a healthy sign, but the quantity of such valuable advertising matter has not yet begun to reach the proportions of intensity which the present emergency requires. Institutional publicity will be more and more in evidence but the dissemination of technical information within the limitations of defense restrictions will show a spirit of national service which will bring commendable praise to the companies using space for the purpose.

Keeping the Balance

Those who attended the Annual Honors Night Dinner of the Institute received invitations to view a collection of children's books from the Bella C. Landauer collections dealing with aviation. These books are on exhibition in the Aeronautical Archives of the Institute.

It may be asked why, in times like these, such an exhibition should be held. Yet, if the question is examined from the long view, it should be observed that it is important to any industry's psychological well-being to retain some semblance of balance, no matter how supreme be the demands placed upon it due to wartime exigencies.

It should also be observed that the interest of many pioneers who are today the leaders in the aviation industry was aroused originally, not by scientific works on the possibility of flight, for these were neither generally available nor intelligible, but by children's books and dime novels which stimulated the imagination of the youth of two and three generations ago and fanned their desire for the conquest of the air.

It is altogether fitting then that during this period, when the industry surges forward at the greatest speed in its history, space be devoted somewhere for a link to the past to which we owe so much. The same kind of literature translated into terms which today's youth understands and appreciates is even now lighting the way for tomorrow's pioneers and leaders in the world of aeronautics.

Restrictions Hit the Press

To a large extent this month's crop of information culled from the aeronautical press is afflicted with "information-anemia." This may be taken in large measure as an indication of the high regard that aeronautical publishers have for their responsibility for the nation's safety by adhering to wartime press restrictions.

During the period required for clarification and codification of regulations on publishing information, the publishers have, for the most part, endured the restrictions and complied with orders with a minimum of grumbling. Only those who know the inside of publishing know how much more it hurts the editors and publishers than it hurts the readers.

It is hoped that codification of this type of restriction will arrive soon, permitting publishers to balance their books and provide more consistent and interesting reading in the near future. In the meantime, the reading public is asked to show the same fortitude as the publisher.

THEY'RE TOUGH METALS

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News Review

December 10. The War Department approved sites for the construction of seven bombardment air bases, at a total cost of $7,500,000. They will be located at Syracuse, New York; Richmond, Virginia; Greenville, South Carolina; Nashville, Tennessee; Walla Walla, Washington; Rapid City, South Dakota, and Columbus, Ohio.

December 10. Maj. Gen. John F. Curry, former head of the Northwest Interceptor Command, was appointed national commander of the Civilian Air Patrol. The appointment of State wing commanders to enlist 90,000 civilian pilots and the use of 23,000 civilian aircraft was also announced.

December 11. Japanese parachute troops seized an airport six miles from Illagan in Isabela province, the Philippines.

December 11. Capt. Colin P. Kelly, Jr., scored three direct bomb hits on the 29,330 ton Japanese battleship *Haruna*, leaving the craft in flames and in distress. In accomplishing this, Captain Kelly lost his life.

December 11. Regulations for the reinstatement of private and commercial flying licenses were issued by the Civil Aeronautics Board. Reinstatement is contingent upon proof of character, citizenship and loyalty to the United States.

December 13. Secretary of the Interior Ickes, acting as Petroleum Coordinator, issued orders making it impossible to manufacture, sell or ship aviation gasoline without his expressed approval.

December 14. Melvin N. Gough, senior test pilot for the National Advisory Committee for Aeronautics was named by the Institute of the Aeronautical Sciences as the 1941 recipient of the Octave Chanute Award for aeronautical research by pilots.

December 16. Ownership of Marquette Airlines was officially transferred to Transcontinental and Western Air, Inc., following a recent purchasing authorization issued by the Civil Aeronautics Board.

December 17. Pan American Airways' *Capetown Clipper* arrived in New York after completing its first round trip to the Belgian Congo.

December 17. Prof. Richard V. Southwell of Oxford University, delivered the fifth annual Wright Brothers lecture before the Institute of the Aeronautical Sciences at Columbia University. In his lecture entitled "New Pathways in Aeronautical Theory," Dr. Southwell explained new and unorthodox methods of analysis being applied to the solution of aeronautical problems under the pressure of war conditions.

December 17. Vice-President Henry Wallace, in behalf of President Roosevelt, presented the 1940 Collier Aviation Trophy jointly to Dr. Sanford A. Moss and the Army Air Corps for outstanding success in the development of the turbo-supercharger.

December 18. In a rearrangement of Pacific commands following a report by the Secretary of the Navy, Lieut. Gen. Delos C. Emmons was appointed to command the Hawaiian department of the U.S. Army relieving Lieut. Gen. Walter C. Short. Brig. Gen. Clarence L. Tinker, former Chief of the Third Interceptor Command at Tampa, succeeded Major Gen. Frederick L. Martin as commander of the Hawaiian Air Forces.

December 20. Dutch pilots flying American Martin bombers scored hits on two Japanese cruisers and two transports in an attack on Japanese landing forces at Miri, Sarawak.

December 23. Dutch Naval aircraft attacked Japanese surface craft in the Philippine harbor of Davao.

December 23. The War Department asked President Roosevelt to award Distinguished Flying Crosses to 75 Army pilots who took part in the secret mass transfer of four-engined bombers to the Philippines last September.

December 25. A U.S. Army bomber destroyed a Japanese submarine off the California coast, according to the War Department's Christmas Day Communiqué.

December 27. Japanese aircraft bombed Manila after the Philippine capital was declared an open city.

December 28. The first group of Latin-American students, selected by five Central American countries for aviation training, arrived in New York. They are the first of a large group of over five hundred who will be trained as pilots, engineers, mechanics and administrative workers under a Federal scholarship plan.

December 31. Maj. Gen. Walter R. Weaver, commander of Maxwell Field, was assigned as acting chief of the Air Corps.

January 1. The Army Air Corps Ferry Command announced that civilian pilots would be accepted to fly lend-lease aircraft from the factory to foreign receiving stations.

January 1. Secretary of War Stimson announced the beginning of field tests on commercial-type light aircraft, flown by enlisted pilots, to be used as part of field artillery units.

January 2. The U.S. Navy commissioned the initial squadron of nonrigid patrol blimps to act as antisubmarine patrol. The first unit, under Lieut. Comm. Raymond T. Tyler was authorized to commence operations at Lakehurst.

January 3. President Roosevelt and Prime Minister Churchill announced a unified allied command in the Southwest Pacific area. Maj. Gen. George H. Brett, Chief of the Army Air Corps, will act as deputy commander.

January 5. U.S. Army bombers scored three direct hits upon a Japanese battleship and sank a destroyer near Davao, Philippine Islands.

January 6. President Roosevelt, in his budget message to Congress asking for an expenditure of $56,000,000,000, stated that he had directed government agencies to increase airplane production to 60,000 units.

January 6. Brig. Gen. Donald H. Connolly resigned as the administrator of Civil Aeronautics to return to active duty and direct civil air activities for the War Department.

January 6. The Brazilian Government seized the German-controlled Condor airlines, stating that in the future all the airlines stock was to be owned by native Brazilians.

January 6. The *Pacific Clipper*, under the command of Capt. Robert Ford, arrived in New York after a record 24,686-mile flight from Auckland, New Zealand. The Clipper was caught between New Caledonia and New Zealand by the outbreak of the war.

January 9. The Senate Military Affairs Committee approved the nomination of Maj. Gen. George H. Brett for elevation to the rank of Lieutenant General.

Military Mission... KOLLSMAN'S LOCKHEED

LABORATORY TESTS ARMY-NAVY AIRCRAFT INSTRUMENTS

Every day, pilots of the United States and Allied forces are learning new lessons in combat flying.

As a result, suggestions for improving instruments constantly come from men on the fighting fronts.

And constantly, Kollsman is faced with the problem of exploring the worth of new ideas. Improvements are made by master craftsmen. But no matter how expert the work in the shop, the instruments must be tested and proved under actual flight conditions.

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A Review of Rotating Wing Aircraft —1941

ALEXANDER KLEMIN*

Introduction

A review of progress in rotating wing aircraft during the year 1941 is naturally hampered by the fact that both design features and technical studies remain for the most part undisclosed because of war conditions. However, even the meager information which it is possible to present gives evidence of vigorous growth in the art.

Military and Naval Uses

FROM THE POINT OF VIEW of utilization in Army work, the demonstrations given by the self-catapulting autogiro Model PA-36 of the Pitcairn-Larsen Autogiro Company (now a part of the A.G.A. Corporation) were most encouraging. This autogiro, fully described in the technical press in the year 1940, is of all-metal construction and incorporates many refinements. The demonstrations of this machine were given to Army representatives at Bolling Field, Fort Bragg, Fort Knox and Fort Sill.

Flights were made to carry out military tasks such as artillery reconnaissance and liaison work, and to operate from highly restricted terrain. In the course of these demonstrations, the autogiro landed and took off from the top of a hill with steep slopes on three sides and an almost perpendicular cliff on the fourth. Normal landings and take-offs were made in an area 35 × 45 ft. and under adverse weather conditions. Operations were also carried on from plowed fields, rocky terrain, rain soaked and swampy areas—the types of difficult terrain which might be used by Army forces under actual combat conditions.

There has also been during the year frequent discussion of the use of the autogiro in naval operations. Authoritative articles have appeared making out a good case for the use of the autogiro in convoy work with the probability that the autogiro would be the most effective against under-sea attack. As one writer has it, "If submarine commanders knew that there were a number of these slow-flying aircraft protecting convoys which their periscopes with their horizontal vision might be unable to pick up, torpedo attacks would be less skillfully directed than would otherwise be the case. Submarines fear depth charges, and depth bombs from the air are just as effective as if dropped off the deck of a vessel. Further, there is increased visibility from altitude and increased visibility arising out of slow flying speed. Both factors would give the autogiro observer greater ability to detect submarines."

Against surface raisers the effectiveness of autogiros would probably be less, but even here four or five rotary aircraft attacking from various directions would make a formidable enemy for the surface raider. If attacks on convoys were made by aircraft, the autogiro would probably be the least effective.

Similar views were expressed by another writer who pointed out that the operation of the conventional type of seaplanes from merchant vessels requires the installation of catapults for launching and of methods for hoisting aboard—a particularly difficult operation in rough waters.

* Guggenheim Research Professor of Aeronautics, New York University.

The use of Hurricanes and other single seater fighters of relatively short range catapulted from a freighter is effective but is hazardous for the pilot. He cannot land on the deck of the freighter. He can either seek a land airport if his fuel is sufficient or mush into the water as near a ship as possible and save himself with a life belt. It is understood that much valuable equipment and still more valuable lives have been lost in such operations.

The writer was of the opinion that rotating aircraft of the wing type can be produced capable of operating from and landing on the short deck on the stern of a merchantman without a catapult or equipment for hoisting aboard and that such aircraft could carry a military load of pilot, observer, radio and depth charges and so would be in a position to apply increasingly effective pressure against submarines. Here is the specification in the words of the writer:

"It should be possible to build such a machine capable of fulfilling service requirements for convoy escort duty and capable of easily operating with an adequate load of depth charges, pilot, observer and two-way radio from and to a platform 100 × 50 ft. in size or less. This type of machine should have a range at optimum cruising speed, estimated at 60 knots, of at least five hours. It should have a maximum speed in the neighborhood of 125 knots. Because of the absence of wings and rotation of the blades in flight, it would be an extremely difficult object to discern at any distance. Yet it should be capable of spotting a submarine more readily than the lookout on board a destroyer and should be able not only to give prompt warning to the convoy but to summon the service of aircraft to its immediate assistance."

Sikorsky Helicopter

Perhaps the outstanding achievement of the year has been the remarkable showing of the helicopter developed by Igor Sikorsky of Vought-Sikorsky Aircraft.

It will be remembered that the Model VS-300 helicopter was extensively tested and flown from March to October 1940. It then, as is well known, demonstrated its ability to rise and climb vertically, hover over one spot and otherwise show complete control in gusty weather. Built for experimental purposes with open tubular welded framework, the machine included near its center of gravity a 90 hp. engine and a simple transmission which put most of the power into the vertical shaft of the main lifting rotor.

A light horizontal shaft originally carried a small part of the power to the end of the fuselage on which were situated three auxiliary rotors used for control of the aircraft and for the compensation of the torque of the main rotor. It was by the use of these three auxiliary rotors that normal airplane stick motions could be duplicated so as to give control of the helicopter whether in hovering motionless over a given spot, traveling forward, sideways or backward.

In the VS-300 control was obtained by changing the pitch of the three auxiliary rotors; thus moving the control column or stick from side to side differentially changed the pitch in two horizontal auxiliary rotors causing lateral or aileron reaction. By moving the stick forward and backward the pitch on the two horizontal rotors was changed simultaneously in the same direction, thereby achieving longitudinal or elevator reaction.

Rudder action was achieved by a foot pedal connected to the pitch control of the vertical auxiliary rotor. This vertical airscrew thus served a dual purpose; namely, that of counteracting torque produced by the single main lifting rotor and as a means of changing direction of flight. These three auxiliary screws had a diameter of 7½ ft., were lightly loaded, and rotated approximately four times as fast as the main rotor.

The main lifting rotor, as its name implied, furnished the major part of the lifting force and had three blades of fourteen foot radius. This lifting force could be so varied both in magnitude and direction as to produce hovering, vertical, forward, sideways and backward flight. The variation of the magnitude of the lift was accomplished by changing the pitch of the three main rotor blades. The direction of flight, however, was governed by the three auxiliary rotors, it being only necessary to tilt the whole ship slightly in any desired direction of flight.

When the r.p.m. of the main rotor fell below a definite value, an automatic device changed the pitch of the main rotor. If engine failure occurred, the pitch of the main rotating surfaces would be so decreased that they would continue in auto-rotation and the helicopter would be converted into an autogiro.

Another interesting feature was the synchronization between the engine throttle, the main lifting rotor and the two horizontal auxiliary rotors. This synchronization became very necessary when switching from hovering, or vertical flight, to say forward flight, since the pitch of the main lifting rotor is naturally greater when producing enough lift to hold the craft motionless, or while ascending vertically, than when forward motion is introduced.

However, since increasing the pitch of the main rotor blades meant additional horsepower in order to maintain a constant r.p.m., the pitch control lever was connected to the engine throttle, thus an increase or decrease in pitch automatically meant an increase or decrease in power transmitted to the main rotor. On the other hand, any variation of lift and power occasioned in the main rotor alone, unless the two rear horizontal auxiliary rotors were synchronized with it, would produce either a tail up or tail down condition. Therefore, the main pitch control was connected to the longitudinal control; in this manner, level flight was assured at all times. Of course, the pilot could vary the actual amount of power of the engine at any time by a separate hand throttle.

The necessary flight controls thus numbered essentially three; namely, the control column, or stick, the rudder pedals, and the main pitch control lever. It can be readily seen that flight was possible without subjecting the pilot to other than normal airplane flight reactions. A great advantage of the control system of the helicopter of this type over that of the conventional fixed wing airplane is that in the former the "feel" and effectiveness never vary, regardless of the attitude of the craft, since the control surfaces are always rotating at a speed far in excess of the stalling speed of their particular airfoil section.

The above description is substantially that offered by Mr. Sikorsky himself at the January 1941 annual meeting of the Institute, as a fitting introduction to later developments which the VS-300 has undergone in the last few months. These developments may best be described in the designer's own words:

"During the summer we introduced a rather important change in the control of the VS-300—we eliminated the outrigger arms at the tail of the ship which previously carried the two horizontal control propellers which provided longitudinal and lateral control. For longitudinal control, we placed one horizontal propeller on a structure directly over the tail. The increase or decrease of the pitch of this propeller acted just as did the simultaneous increase or decrease of the pitch of the two horizontal propellers in the previous arrangement.

"However, for lateral control we worked out a kind of cyclical pitch for the main rotor blades so that if tilting to the right was required, we could increase the pitch of the blades as they pass on the left of the ship and decrease the pitch as they pass on the right side. Tilting to the left was accomplished in the reverse manner. Thus, in the present aircraft, lateral control is secured in the main rotor, while horizontal and directional control comes from the two remaining auxiliary rotors at the tail.

"The present aircraft has been found to have most excellent characteristics of stability and control. We have found that in all of the true helicopter characteristics, such as vertical ascent and descent, hovering, backward and sideways flying, we have sacrificed nothing. On the other hand, we have secured a remarkable degree of stability and have not even approached any unpleasant characteristics throughout the entire range of performance. Forward speeds up to 60 m.p.h. or over have been almost routine, but the ship has not yet been found to approach its maximum speed. It has been routine performance to approach and hover near persons on the ground, either for loading and unloading objects on the aircraft, or for inspection of the craft while in flight, or for giving instructions to the pilot. Landings are regularly made within a few inches of a predetermined spot on the ground.

"During the fall, we did considerable flying with the aircraft mounted on pontoons, and it was found that on the surface of the water the craft is more controllable than any other surface vessel. It not only taxies forward and backward, as do other surface craft, but it can also come to a complete stop without disengaging a clutch or stopping the engine; it can taxi sideways even against a strong current, in spite of the powerful resistance of its long pontoons; and it can turn complete circles precisely on one spot. In the air, the craft is every bit as agreeable as it is when mounted on wheels. Altitude has not yet been investigated, flight having been voluntarily restricted for the present to heights of not over 100 ft."

Some remarkable records have been achieved with this helicopter during the year. Thus on May 6, 1941, the world's record for endurance was established when the aircraft remained in the air 1 hour, 32 minutes, 26.1 seconds—thereby exceeding the previous world's record held by Germany. During this entire flight it hovered above an area less than half an acre in extent. A seaplane flight has been made in the Housatonic River adjacent to the Vought-Sikorsky factory. The machine hovered over the water for a minute or two. Flotation was made possible by removing the landing gear and replacing it with cigar shaped rubber floats—two under the main part of the machine and one at the tail.

The Kellett Autogiro

It has been known for some time that the Kellett Autogiro Company has delivered autogiros to the Army Air Corps which have received extensive service tests for the cavalry, field artillery, coast artillery and the infantry. These aircraft were of the YG-1B type, powered with 225 hp. motors, with direct control but without provision for accelerated or direct take-off. With the lessons learned through these tests under service conditions, the Kellett Autogiro Company in collaboration with the Army Air Corps has concentrated on improving such characteristics as landing, take-off and all-round performance. There have also been sought improved vibration characteristics and lessened pilot fatigue by transmission of rotor actions through the control system. It is an advantage of the rotor that it may yield under gusts but it is not an advantage if the yielding of the direct control autogiro reflects itself in stick forces in the pilot's hands.

It is interesting to learn that tapered rotor blades have been employed and are designed for constant center or pres-

sure. Even though analogy with the fixed airfoil is not complete, it is an advantage to have tapered rotor blades since there is thus obtained a more uniform load distribution along the rotor disk and hence more uniform distribution of downwash through the rotor and thereby greater aerodynamic efficiency. It will be remembered that the fixed airfoil, which has maximum induced drag, is of elliptical plan form in which downwash at the wing is constant from center to tip.

Another advance is in the rubber mounting of the pylon with a view to improving vibration characteristics. While feathering control has been known for some time, its installation on the XR-3 autogiro perhaps marks its first advent in American aviation. It has often been argued that feathering control is preferable to direct tilting of the rotor as likely to be more sensitive and less capable of transmitting rotor reactions to the pilot.

The Pitcairn-Larsen Autogiro

The very excellent showing which the Pitcairn-Larsen PA-36 made in tests by the Army Air Corps has already been mentioned. This machine is so well known and has been so well described in a previous year that but one feature remains to be mentioned. This feature is that the PA-36 in skilled hands has rapidly landed on a space 5 ft. square. Many Naval officers have said that similar speed landings on ship decks are feasible. However, when the pilot makes contact with the deck, some method of immediately making the aircraft fast must be available. The Pitcairn-Larsen Autogiro Company has developed a landing device, which is still in the confidential stage, but for which is claimed a practical method of fastening down that is quick and effective. The arresting gear in the proper sense of the word is not needed in deck landings because there would be in use little or no forward motion. In fact, in operations over the sea where some wind is invariably present, all landings could be vertical.

The Platt-LePage Helicopter

It has for some time been known that Platt-LePage Aircraft Company has a contract from the Army Air Corps for military type helicopters which are undergoing tests. The prototype is of extreme interest but its design features and tests as well as expected performance remain secret for the moment.

The Arthur Young Helicopter

It is an open secret that Arthur M. Young, an independent worker in the field, has placed his helicopter for further development in the hands of one of our most important aircraft companies.

Helicopters of the single rotor type with the airscrew at the tail end of the machine to provide anti-rotating torque appear to be attracting maximum attention. The Young helicopter belongs to this category—at least in its model form. In the helicopter hitherto, in the hovering or vertical ascent condition it has been argued that control could readily be obtained but that stability was very difficult of attainment. In the Young helicopter it would appear that a two-bladed rotor is employed; that the aircraft is universally mounted below the rotor and that a fly wheel or gyroscopic element so controls the rotor that it always maintains a horizontal position even in hovering, while the fuselage has more freedom relative to the rotor. Model tests have been very impressive both in control and stability.

Conclusion

So much has been written on the future possibilities of rotating wing aircraft that it seems out of place to discuss it here. The increasing encouragement given to rotating-wing aircraft by the U.S. Army and by the British indicate fully the value that is attached to it by military authorities. The remarkable performance of the Sikorsky helicopter has encouraged greatly the view that private flying in the postwar period will find rotating wing aircraft of the autogiro or helicopter type of great interest.

Technical Literature

A few references are given in technical literature during the year which have been scanty. With the cooperation of the Aeronautical Archives of the Institute of the Aeronautical Sciences a limited bibliography covering the year 1941 is appended to this article to assist researchers and others in keeping abreast of the technical developments in this field.

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Notes on the VS-300; *The Sportsman Pilot,* June 15, 1941, pages 10, 11, 48.

Helicopter Flights in the U. S. A.—Sikorsky; *The Aeroplane,* June 6, 1941, page 625.

Sikorsky Helicopter; *American Aviation,* June 1, 1941, page 16.

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Future of the Helicopter, by Igor I. Sikorsky; *Aero Digest,* June 1941, pages 120, 121.

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Recent Air Corps Developments in Rotating Wing Aircraft, by H. F. Gregory; *Journal of the Aeronautical Sciences,* June 1941, pages 331–333.

Sikorsky Helicopter Sets Endurance Record; *Aero Digest,* June 1941, page 82.

Hovering Record; Sikorsky Helicopter Aloft for Sixty-Five Minutes; *Flight,* May 29, 1941, page 374.

Anti-Submarine Measures; Old and New, by William A. Reed; *Proceedings of U.S. Naval Institute,* May 1941, pages 638–640.

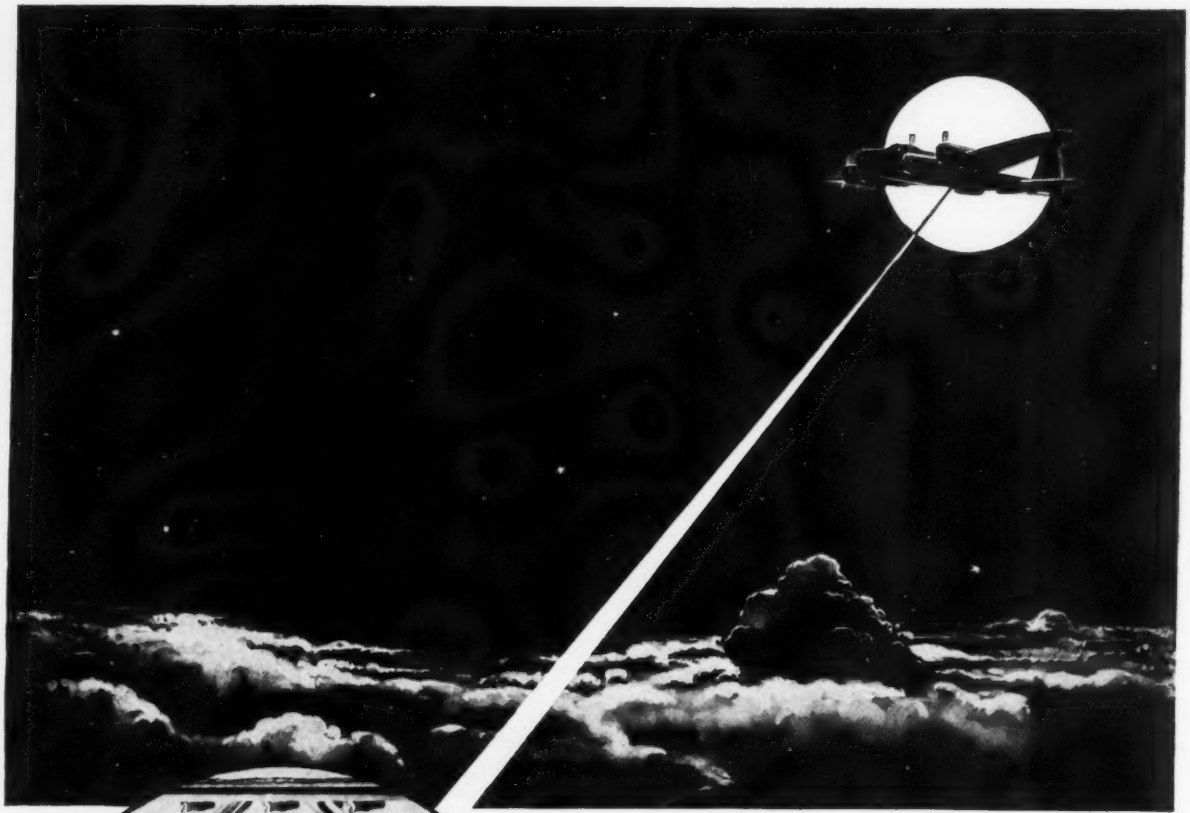
Hubschrauber oder Autogiro, by Willy Ley; *Schweizer Aero-Revue,* April 1941, pages 11, 12.

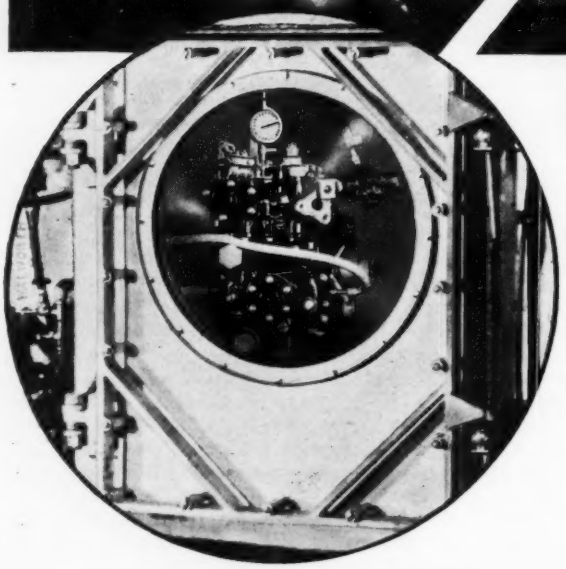
Results of Tests With Helicopter; *Barron's,* February 17, 1941, page 5.

Vought-Sikorsky Helicopter VS-300; *The Aeroplane,* February 2, 1941, pages 233, 234.

Capable of Vertical Take-Off; Pitcairn Autogiro; *Product Engineering,* February 1941, pages 58, 59.

Mr. Sikorsky Made It Work, by Mark Mason; *Southern Flight,* January 1941, pages 7, 16.





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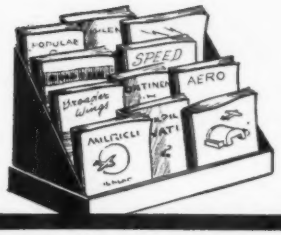

Periodicals

The views and opinions expressed in this section are exclusively those of the writers or publications named. They are in no case to be construed as those of the Aeronautical Review or the Institute of the Aeronautical Sciences.

Aerodynamics

Lo Stato Attuale delle Ricerche sul Moto Instazionario di Una Superficie Portante (Actual Status of Researches on the Non-uniform Motion of a Carrying Surface). P. Cicala. Summary of the actual principal research results on the non-uniform motion of a carrying surface in a non-compressible fluid, and information on the methods used by various investigators. *L'Aerotecnica*, September-October 1941, pages 557–591.

On Some Vortex Theorems of Hydrodynamics. Max M. Munk. A study of some of the basic principles of hydrodynamics dealing with the determination of fluid motion when the boundaries of the fluid and the external forces acting upon it are given. *Journal of the Aeronautical Sciences*, January 1942, pages 90–96.

Air Cargo

Air Cargoes of the Future. C. P. Graddick. The air express mail freight director of United Air Lines predicates the development of air cargoes with observations on current trends as to quantity and types of shipment and methods of handling. *Airlanes*, December 1941, pages 8, 9, 20, 8 illus.

Air Pick-Up System in the United States. Description, history and development of the air mail and express pick-up system developed by All American Aviation Inc. *Modern Transport*, August 9, 1941, pages 3, 4, 4 illus.

Air Policy

Revolving Loan Fund is Suggested to Help Aviation Students. A plan is outlined for aiding to fill the ranks of badly needed aircraft technicians and ground men. It was devised by Maj. C. C. Moseley, president of Curtiss-Wright Technical Institute of Aeronautics, with a view to avoiding the outlay of huge sums of Government money. It is based on a revolving loan fund for ambitious and deserving men who lack finances to complete their training. *Southern Flight*, December 1941, page 27, 2 illus.

A Plan For Civil Aviation. Considering the problems in air transportation which will arise when nations go back on a peacetime basis, this article offers an analysis of two possible plans for British operation. One is the continuation of virtual monopoly, as exemplified by British Overseas Airways, the other being the old competitive system operating under an International Air Traffic Association. *Modern Transport*, December 20, 1941, page 3.

French Lesson. Paul E. Lamarche. A study of the industrial demoralization which, according to the writer, led to the defeat of France. *Aviation*, January 1942, pages 56, 57, 208, 210, 212, 3 illus.

Air Power

How Good is the Jap Air Force? Charles Healy Day. On the basis of his experience in spending the last five years building military aircraft for the Chinese and dodging Japanese bombers in the process, the writer offers an estimate of the strength and character of the Japanese air force. His observations are in line with his assertion over a long period that military experts have underestimated the quality of the Japanese air force.

Among underestimated factors in Jap air power, the writer includes the following: progress in design and aerodynamics; engineering development; the quality of Japanese imitations of American designs both in engine and in aircraft; air war tactics which he says are greatly improved as a result of Japanese experience in China and the effectiveness of their aircraft carrier operations. *Aero Digest*, January 1942, pages 58, 59, 6 illus.

Aircraft in the Pacific. A survey of Japanese air equipment as it stacks up against the multiplicity of types in use by the Allies. The uses for which the various types are employed are given more attention than descriptive in-

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formation regarding the airplanes themselves. *Flight*, December 18, 1941, pages 448–451, 9 illus.

Japan Declares War. An analysis of Japanese air power, particularly as relates to the significance of Japanese entry into the present World War. Organization, equipment and historic development are noted together with the active influence of German air officials and politics. *The Aeroplane*, December 12, 1941, pages 640, 641, 1 illus.

Japan's Air Power. Gordon A. Reeves. Superficial data on standard models of Japanese military aircraft in current service. A brief estimate of Japanese air power in numbers and types is included. *Canadian Aviation*, January 1942, pages 14, 15, 17, 29–31, 15 illus.

The Russian Air Force. An editorial evaluation of Russia's air strength. It is indicated that, when the war with Germany began, Russia is believed to have possessed between 6,000 and 10,000 military aircraft, divided in the proportion of 40 per cent bombers, and 15 per cent reconnaissance and naval air arm craft. *The Engineer*, November 7, 1941, pages 314, 315.

The Sky is the Limit. C. G. Power. The Air Minister of Canada surveys in this article Canada's wartime aviation. Among phases the status of which is discussed are manpower, home defense facilities, the Women's Auxiliary Air Force, the Air Cadet program, the supply of aircraft, overhaul operations and the activities of various training schools, including a "ceased training" school established to salvage those persons who failed on their first attempt to qualify as pilots. *Canadian Aviation*, December 1941, pages 24–27, 4 illus.

Air Transport

Airway Traffic Control. John N. Becker. A general outline of the operational problems involved in handling airway traffic control under Civil Aeronautics Administration regulations. *Canadian Aviation*, January 1942, pages 25–27, 4 illus.

Cooperation and Competition. An examination of the air transport situation in the Middle East and Africa as pertains to operations of Pan American Airways and British Overseas Airways. Citing the shorthandedness of the latter, the writer points to the common objective of both companies from a commercial as well as a political point of view. He urges a cooperative as opposed to a competitive treatment of the situation. *The Aeroplane*, November 28, 1941, pages 605, 606, 1 illus.

Expansion in Memphis. George E. Bounds. An historic note on the rapid development of Chicago and Southern Air Line, Inc., with a description of the company's new office building and general overhaul base recently completed at a midwestern municipal airport. *Airlanes*, December 1941, pages 6, 7, 18, 4 illus.

M-Day In The Pacific. William Van Dusen. Pan American Airways' public relations director outlines the manner in which the entire P.A.A. operation in the Pacific was mobilized and geared to war conditions within almost a half hour of the first flash of news of the attack on Honolulu. Within another hour the entire Atlantic network was similarly swung into war harness. *Yankee Pilot*, January 1942, pages 16, 17.

Aircraft Spotting

German Aeroplanes in Service—XII–XVIII. Weekly columns presenting drawings and such information as is available on various types of German airplanes in current service. Where known, data given include dimensions, weights, crew complement, performance and armor. *The Aeroplane*, November 14, 1941, page 549, 6 illus.; November 21, 1941, page 573, 6 illus.; November 28, 1941, page 603, 6 illus.; December 5, 1941, page 632, 6 illus.; December 12, 1941, pages 662, 663, 11 illus.; December 19, 1941, page 688, 6 illus.

These Are the Axis Planes to Look for—These Are Our Planes. Silhouettes of Japanese, German, Italian and American airplanes in current military service are presented along with their identifying names. *Collier's*, January 10, 1942, page 14, 44 illus.

The Japanese Army Air Force and Navy Air Force. Lateral views of Japanese war planes in current service are presented along with the little data that is available regarding their specifications and performance. *The Aeroplane*, December 19, 1941, page 674, 20 illus.

Spotters on the Spot. The National Aeronautics Association has been cooperating to make the Aircraft Warning System effective. Details of this cooperation are given with an outline of the Aircraft Warning organization. *National Aeronautics*, January 1942, pages 10, 11.

Enemy Aircraft—Recognition Series No. 1, 2—Japanese. Outline drawings and chief descriptive data available are given for the Nakajima types 19, 94, 95 and 97, the Mitsubishi Soyokaze, and Karigane Type, Kawasaki Type 93 and the K.F-1 Navy Type. *Western Flying*, January 1942, pages 26, 27, 8 illus.

Airplane Descriptions

The Avro Manchester. Although no performance figures of the Avro Manchester (two 24-cyl. liquid-cooled X-type Rolls-Royce 1,760 hp. Vulture engines) are given, interior and exterior views of the new heavy bomber show interesting design details. Slightly smaller than the Halifax and Stirling (and with rather less power) the Manchester takes a heavy load of bombs at a high speed and is well armed with two-gun turret in nose, a two-gun turret amidships on top of fuselage and a four-gun turret in the tail.

Only the cowlings and coolers of the powerful Vulture engine are shown. Although the Manchester went into service with a single fin besides twin fins and rudders at the tips of tailplane, it has now been modified to have two larger fins and rudders, and the central fin has been removed. The Manchester is of all-metal construction with stressed skin covering. Vulture engines drive three-blade constant speed propellers.

Dimensions are given: span, 90 ft. 1 in.; length, 70 ft.; height, 19 ft. 6 in. *Aeroplane*, November 14, 1941, pages 540, 541, 7 illus.; November 21, 1941, pages 564, 565, 4 illus. Also *Aircraft Production*, December 1941, page 106.

Curtiss-Wright St. Louis. A Curtiss-Wright twin-engine CW-20, designed a little over a year ago as an experimental stratosphere aircraft with pressure cabin, and purchased by the British Government for British Overseas Airways, arrived in England recently. As originally designed, the CW-20 was to have a pressure cabin in which a cabin atmosphere would be maintained equal to that at 6,000 ft., when the airplane was flying at 20,000 ft. This apparatus was never installed and the airplane operates as a normal atmospheric type.

Two Wright Cyclone engines supply a total of 3,400 hp. Cabin accommodates 24 passengers, as well as two 620-gal. supplementary fuel tanks which increase range to 4,000 miles. Some notable changes in tail unit design have taken place since the St. Louis first took the air. The original design employed twin fins and rudders outrigged on tips of a tailplane which had dihedral angle. As vertical surfaces were set at right angles to the tailplane they canted in at the top. The CW-20 now possesses a single fin and rudder, with a resulting improve-

ment in appearance as well as behavior. All-up tonnage is around 40,000 lb. at which climb can be made from 9,000 to 12,000 ft. on one engine. *Flight*, December 18, 1941, pages 441, 442, 3 illus.; also *The Aeroplane*, December 19, 1941, page 685, 1 illus.

California Manufacturers' Contribution to the War. Lt. Col. Charles E. Branshaw. A survey of the military aircraft types now being produced by manufacturers in California. *Aero Digest*, January 1942, pages 74, 311, 1 illus.

A Simple Trainer. A description of the Taylorcraft trainer built in England is given with a view to indicating the extent to which this product corresponds to the ideal trainer suggested by a *Flight* contributor in the issue of October 2. *Flight*, December 11, 1941, pages 420b, c, 4 illus.

Duitschland's Nieuwste Jachtvliegtuig (Germany's Newest Pursuit Plane). According to reports from England and from the Eastern front, Germany has a new pursuit plane, the Messerschmitt Me. 109F which is designed for stratosphere flight. It is equipped with a 1,375 hp. Benz BD engine which has its maximum output at an altitude of 7,000 m. The service ceiling of this airplane is not less than 13,000 meters.

It differs from the previous models by the different arrangement of the tail surfaces. Its span is about 12 meters which brings the wing area up to 17 square meters. To get a better streamlining the cockpit is placed farther back into the fuselage. It has a trailing antenna; landing gear and tail wheel are retractable.

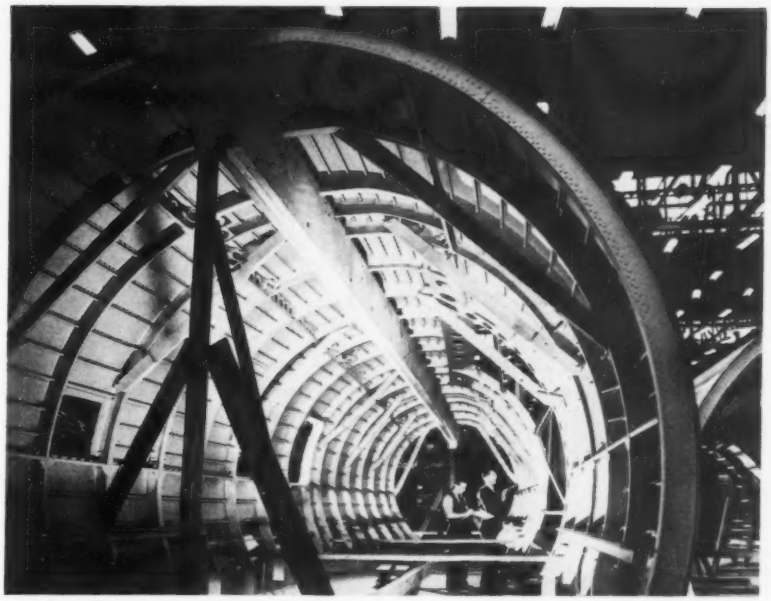
The armament is not as heavy as on the previous models; it consists of one 20-mm. cannon, and two machine guns. However, the armor is heavier—18 millimeters thick. *Luchtvaart*, October 21, 1941, pages 398, 399.

An Improved Flying Fortress. Brief notes on improvements in the design of the Boeing B-17E with data on the Wright engines, exhaust turbo-superchargers and armor. *Aircraft Production*, December 1941, page 73, 1 illus.

Trials Completed. Photographs and a little descriptive matter on the Douglas B-19. *Flight*, December 11, 1941, pages 420d, e, 6 illus.

Victory Trainer. A description of the Morrow Victory Trainer, a high speed training airplane manufactured of plastic-bonded plywood as a substitute for aluminum needed in the fabrication of bombers and fighters. Specifications are given and plastic applications in the design of the craft are described. *Modern Plastics*, January 1942, pages 42, 43, 4 illus.

The Messerschmitt Me.110. A new version of Me.110, the Me.210, is now believed to be in service. Russian sources report it has been in production for some time. Engines are apparently the 1,500 hp. DB 603's. Top speed is estimated at about 390 m.p.h. at 19,000 ft., when not carrying bombs, for which it is apparently equipped. Photos, silhouettes, dimensions and performance of standard Me.-110 two-engine fighters are presented. *Aeroplane*, November 28, 1941, page 602, 9 illus.



Inspectors check the interior of the upper forward section of the fuselage of the Curtiss C-46, the new Army cargo airplane now being produced by the Curtiss-Wright Corporation.

Vought-Sikorsky Flying Boat. Clinton B. F. Macauley. A detailed description of the Vought-Sikorsky VS-44-A four-engined flying boat built especially for American Export Airlines' projected transatlantic service. *Aviation*, January 1942, pages 60–63, 192, 194, 19 illus.

Heinkel He.111HaE. Latest in the long line of Heinkel He.111 designs, the He.111HaE, used as a bomber and torpedo bomber by the *Luftwaffe*, can carry two torpedoes of 1,764 lbs. each, slung side by side under fuselage on external racks. It does not differ externally from the familiar He.111K's, except that it is believed to have two 1,150 hp. Mercedes-Benz DB 601N engines with flame-trap exhausts for night flying. In the new model the five machine-guns (standard armament) are reinforced by a forward-firing 20-mm. cannon in the transparent front of the under-gun cupola.

Photographs of several Heinkels shot down recently show a curious arrangement in the extreme tail behind the rudder. It is apparently a capapult device for discharging small canisters of explosives in the wake of the machine as a protection against fighters sitting on the tail. This device is sometimes replaced by a 7.9-mm. fixed machine gun firing backward. Some Heinkels have a hook on the tail for towing gliders. Armor is now fitted extensively around Pilot and gunners. Some specification and performance data are given for the He.111HaE. *Aeroplane Spotter*, December 4, 1941, page 231, 4 illus.

New R.A.F. Types. Spitfire V, single-seat fighter (two cannon and four machine guns) and the Hurricane IIB and IIC (four-cannon or 12-machine gun fighter). Photos and three-view drawings. Brief comment on newer versions of these timed tried airplanes. *Aircraft Engineering*, November 1941, pages 306, 307, 318, 16 illus.

Airports

Object Lesson. Ken Berglund. An account of two aviation enthusiasts who built an airport where funds were low and suitable sites scarce. The manner in which they financed the project and organized a flying club is described. *Western Flying*, December 1941, pages 29, 30, 2 illus.

The Use of Dummies in the Camouflage of Operational Aerodromes. E. Z. Yassin. Dummies are particularly suitable for use in camouflaging operational airdromes; they not only serve to mask aircraft and equipment stationed thereon, but also make it possible to give the flying field the aspect of being unusable for flying purposes.

In recent wartime practice, dummies have been used extensively for airdrome camouflage and have proved particularly effective.

Among the dummies suggested in this article are trees, portable houses, camper's tents, horses, cows, strawricks, and even a kitchen garden. How these dummies are fabricated is described and actual photos and sketches demonstrate their effectiveness. *Royal Aeronautical Society Journal*, December 1941, pages 370–377, 9 illus.

Lighting at the Washington National Airport. W. C. Norvell. A comprehensive discussion of the lighting facilities at the Washington National Airport offering a survey of the equipment and its functions and the method by which it was installed and is operated. *Aviation*, January 1942, pages 142, 143, 198, 5 illus.

Armament

Bristol Turrets. The power-operated gun turret developed by Bristol Aeroplane Co. is described. Illustrations show evolution of the Bristol hydraulic system. Pressures up to 1,200 lbs. per sq.in. with a delivery of up to 180 gals. per hr. are given by the designs of hydraulic pumps now in production. Firing safeguards are outlined and the latest type of Bristol hydraulically operated twin-gun turrets, installed on top of fuselage behind wing, is illustrated. *Engineer*, November 21, 1941, pages 357, 358, 6 illus.; also *Aeroplane*, November 21, 1941, pages 562, 563, 6 illus.

The irregularity of receipt of publications from abroad necessitates the review of articles in issues several months late. This is done to provide readers with information regarding foreign technical progress as soon as the issues are available in the United States.

Torpedoes and Aircraft. This brief history of the hundred year old method of sinking ships by torpedo gives a descriptive summary of torpedo aircraft of two wars. Illustrations show the latest German development—the carrying of two 18-in. torpedoes slung underneath a Heinkel He.111. Diagrammatic section of a Whitehead torpedo is also shown. *Flight*, November 27, 1941, pages 378b, d, 9 illus.

Beating Off Attack. A discussion of the arrangement of defensive armament on military airplanes. Fairey Aviation's new aircraft and its defensive armament have been designed as a complementary whole. New conception has necessitated a special type of fuselage construction and also a new duplex, multigun, retractable turret. Construction is indicated schematically in a perspective sketch.

At intersection of wings a fuselage is a center section which is basically a lenticular structure, adapted to accommodate upper and lower rotatable turrets, each mounting four guns. This center section is provided with appropriate faces and wing roots for attachment of other component units and the whole design is laid out for the dispersed production of such units.

Both upper and lower turrets may be projected from the fuselage to bring them into operative position. When stowed, turrets present a better streamline form than that provided by turrets of more usual construction. With upper and lower groups of guns each capable of rotation through 360 deg. and elevation through an arc of 90 deg., there is virtually an unrestricted field of fire.

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operative position. Only one gunner is required to deal with attack from all quarters. *Flight*, December 4, 1941, pages 402, 403, 3 illus.

The Avro Manchester I. A description of the very large bi-motor type Avro Manchester I bomber about which certain details have not been available until recently. The heavy armor and armament of the airplane are described. The motors are Rolls-Royce Vultures. *The Aeroplane*, November 21, 1941, pages 564, 565, 4 illus.

Aircraft Bomb Fuses. A comprehensive description of the manufacture of M-110 fuses for light fragmentation bombs, now being produced by one of the Westinghouse Electric and Manufacturing Company's plants. The article follows the production process through the production of its 28 parts, indicating how the application of automatic machinery and female labor has made inexpensive and efficient production possible. *American Machinist*, December 24, 1941, pages 1323–1333, 17 illus.

Avigation

The Stars This January. Warren C. Youngclaus. Astronomical data on the heavens during the month of January are presented for the student of celestial navigation. *Aero Digest*, January 1942, pages 69, 296, 1 illus.

Eenvoudige Navigatie ten dienste van de Sportvliegers—XIII (Simple Navigation for Sports Flyers). J. W. Verhoeven. Continuation of the previous article on dead reckoning. This issue features the determination of the "wind point" and the wind triangle. *Luchtvaart*, October 21, 1941, pages 400, 401.

Eenvoudige Navigatie ten dienste van de Sportvliegers—XIV (Simple Navigation for Sports Flyers). J. W. Verhoeven. Continuation of the previous article on dead reckoning featuring the double drift method, the 90° method, and the drift-and-bearing method. *Luchtvaart*, November 4, 1941, pages 425–427.

Business and Finance

War Forces New Plans. Selig Altschul. A general forecast on the disjointing effect that the war with Japan may have on the financial structure of American aviation. *Aviation*, January 1942, pages 153, 232.

Making the Terminal Airport Pay. A financial statement of LaGuardia Field, the New York Municipal airport, presented after the close of its second year in operation. The article indicates how the airport's surplus of $12,685 for the period was achieved through hangar rentals, landing fees for itinerant aircraft, administration building rents and other charges. *Aviation*, January 1942, page 145, 1 illus.

The Measure of Tomorrow. Gill Robb Wilson. Observations by the National Aeronautics Association president on the future of aviation. He writes that "both in national and international development, the destiny of this nation will be found in its aeronautics statesmanship. The economic weight of our defense investment in aviation demands postwar planning of our air commerce." The importance of air cargo as an essential means to air power is emphasized. *National Aeronautics*, December 1941, pages 10, 18, 1 illus.

Civil Air Defense

Ready for Defense. William D. Strohmeier. A suggestion is made in this article that the buildings and facilities of flying clubs at municipal airports can readily be converted into "ready rooms" for Civilian Air Patrols. The article describes typical country club buildings and facilities which are available and can be converted for this purpose. *Aviation*, January 1942, pages 146, 147, 202, 4 illus.

The C.A.P. Takes Over. Current status of the National Civil Air Patrol is reported with a diagrammatic analysis of its organization and notes on the progress made to date by various state units. Questions and answers as published in the official pamphlet of the Civil Air Patrol are appended. *Yankee Pilot*, January 1942, pages 9–14.

Civil Air Patrol. Marc Hanlon. A factual explanation of the organization of this agency of the Office of Civilian Defense established for the preservation of private flying in the United States. Objectives of the plan and its cooperation with other agencies are indicated together with the setup of the branches in various states. *Western Flying*, January 1942, pages 33, 34, 52, 62, 4 illus.

The Civil Air Patrol. A comprehensive study of the function of the Civil Air Patrol which was officially launched under the leadership of Major Gen. John F. Curry. The article explains the structure and objectives of the organization, introduces its key personnel, and informs private pilots and those interested in civil aviation what part they may take in the C.A.P. plan. *The Sportsman Pilot*, January 1942, pages 11–13, 5 illus.

Civil Aviation

Aviation in Brazil Shows Active Progress. Alice Rogers Hager. Stemming from a three-month tour, this first of two articles reporting on the new air activity in Brazil describes the development, chiefly under direct Government sponsorship, of new airports, air schools, airlines and aviation factories. *Aviation*, January 1942, pages 58, 59, 204, 206, 8 illus.

Mexico Spreads Her Wings. Lucien Farkas. Descriptive information and statistics are given on civil aviation in present-day Mexico. *Western Flying*, December 1941, pages 27, 28, 2 illus.

Faith in the Future. Notes on civil aviation in the British Empire from the popular rather than the technical and operational aspects of civil air transport. The importance of ground organization, research and fares within the reach of all prospective travelers is stressed. *The Aeroplane*, December 5, 1941, page 633, 1 illus.

Alaskan Adventure. An account in pictures and captions of a sporting jaunt by air from El Cerrito, California to Fort Gibbon, Alaska, in an Aeronca Chief. *Air Trails*, January 1942, pages 12, 13, 16 illus.

A Plane in Every Garage? Fillmore Hyde. A speculative forecast on the structure, dynamics and function of the private aircraft which it is suggested will probably be turned out in the vastly enlarged aircraft plants of the nation when they are no longer needed for defense work. The article examines the future of the Stout Skycar, the Ercoupe, the Skyfarer, existant types of rotating-wing aircraft and similar types specially designed for safe private operation, and outlines possible future airway and operational conditions which will favor increased usefulness for private flying after the war is over. *Air Facts*, January 1942, pages 11–16, 3 illus.

Design

Tailless Evolution. An article discussing at some length Northrop's "Flying Wing," British versions of the tailless airplane, and German and Russian conceptions of this design. Tabulated data give name, engine, wing span, wing area, loaded weight, maximum speed, date built, type, nationality, and remarks concerning all the tailless designs developed since 1906, when the British Dunne D.1, 15-hp. single-seat pusher monoplane was flight-tested.

In Germany, Messerschmitt is believed to have a tailless two-engine fighter with two 1,500-hp. DB.603

engines. Span is quoted as about 56 ft.; crew of two; armament, two 20-mm. cannon; two 15-mm. cannon and four 7.9-mm. machine-guns. Focke-Wulf is said to have flown a two-engine tailless bomber which has a span of about 103 ft., bomb load of about 3,000 lbs. for 1,200 miles, and a crew of four.

Tailless designs are said by the writer to approach more nearly the elemental ideal of flying than any other conception because all the surfaces contribute toward lift. "Tail units and their supporting bombs or fuselage in conventional designs are mere parasites, necessary to maintain stability and give power of maneuver. Because absence of tail reduces power of control, a tailless airplane is usually slower on the controls than a normal airplane of similar size. A tailless airplane is usually either completely stable or completely unstable. The compromise of control over stability is difficult to achieve, but can be done." *The Aeroplane*, November 14, 1941, pages 542–545, 16 illus.

An Advanced Method for the Determination of Intermediate Wing Contours. T. Gardner Hill and Maxwell B. Bassett. A geometrical method is suggested for the determination of intermediate wing contours for wings with dissimilar or twisted airfoils. As speeds are approaching critical values and the use of twisted and dissimilar airfoils sections is becoming more frequent, the accuracy of the full scale master lines from which wings are constructed is becoming more critical.

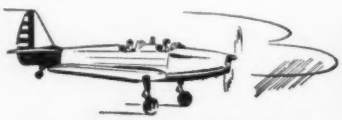
The problem, briefly stated, is to determine intermediate wing contours when the root and tip airfoil sections and their relation to each other are given. It is assumed that the most desirable wing aerodynamically and structurally, where there is no reverse of curvature in the limiting airfoils, is a straight line generated surface about these two limiting sections. Where there is reverse of curvature in just one of the airfoils, a compromise is said to be desirable. *Journal of the Aeronautical Sciences*, January 1942, pages 108, 109, 4 illus.

In Defence of Tails. Roger Tennant. A reflective commentary on published views regarding the development of the tailless airplanes, this article discusses the necessity for tail control-surfaces, basing conclusions chiefly on the assumption that proportionately larger fuselages of the future cannot properly be supported by the short inefficient lever arm available at the wing tips. Other disadvantages of the tailless airplane are pointed out. An editorial reply to this article is included in which the advantages of the tailless airplane are pointed out and various arguments of the writer challenged. *The Aeroplane*, December 5, 1941, pages 620, 621, 4 illus.

Research Leads to Design Improvements. H. Ray Ellinwood. An examination of the relative value of aeronautical research as a major factor in running the present war, this article cites examples of the manner in which aeronautical research leads to design improvements, with particular reference to accessories and parts. The general approach to research in this field is keynoted. *Aero Digest*, January 1942, pages 166, 168, 170, 174, 176, 8 illus.

Lofting Problems of Streamline Bodies. Part 2. Carter M. Hartley and Roy A. Liming. The first of this series introduced a method of classifying curved lines according to certain mathematical characteristics. The mathematical technique presented means by which such curves can be reproduced to any scale mechanically rather than by traditional lofting methods.

In this second installment are presented the basic data essential to the practical application of this method of



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curve development in lofting. It is indicated that careful analysis of typical fuselage development shows that only a few fundamentally different types of curves, classified with reference to position, really exist.

Each of these basic types is illustrated with reference to characteristic location in the typical fuselage. A formula conveniently applicable to the development of equations for all curves of that given type is presented, having been derived by means of the special mathematical technique described in the first of this series. *Aero Digest*, January 1942, pages 180, 183, 184, 10 illus.

Manta Mock-Up. A description of the mock-up design for the Manta long-range fighter now being developed in the United States. It has the engine behind the pilot at the center of gravity, uses an extension drive shaft to the propeller and incorporates the Davis Wing formula used on the Consolidated B-24 bomber. Maximum range is estimated at 2,500 miles; top speed at 445 m.p.h. *Canadian Aviation*, January 1942, pages 20, 31, 3 illus.

New Pathways in Aeronautical Theory. Richard V. Southwell. The fifth annual Wright Brothers Lecture, this paper concerns a "new mathematics" and unorthodox methods of analysis that find their greatest use in the immediate problems of engineering and aeronautical research under investigation by the writer over the past two years. The theories described were a direct by-product of a search for methods more appropriate to the solution of new and urgent problems under wartime conditions.

Chief characteristic of the new methods is the manner in which they take into account the unavoidable uncertainty of some of the physical data available for the solution of a given problem. Examples are given of their application to the stress analysis of frame works, determination of frequencies, modes of vibrating systems and elastic stability of fluid flow.

The writer notes that the new methods usually require laborious computations, but are simple and can be learned by anyone with a facility in arithmetic, so that large numbers of assistants can be trained easily to work on urgent problems. *Journal of the Aeronautical Sciences*, January 1942, pages 77–89, 18 illus.

Designing Sand Castings. James E. Thompson and Rodney B. Campbell. A discussion of the design and production factors in the development of sand castings procedures. It is indicated that German airplane manufacturers particularly have taken full advantage of the production possibility of castings and are using large quantities for major structural elements.

General rules are set down for casting designs. Castings used as structural elements must not be welded. It is not advisable to use castings for fittings or members subject to large concentrated alternating tension loads. Structural castings should not be used in places where they are inaccessible for visual inspection. *Western Flying*, January 1942, pages 39–41, 62, 9 illus.

Engines

Aviation Diesel Engine With Uniflow Scavenging. Description of a four-cylinder, air-cooled, opposed type, opposed-piston, two-cycle Diesel engine being developed by the Uniflow Diesel Corporation for aviation use. *Diesel Power and Transportation*, November 1941, page 956, 1 illus.

A New Theory of Combustion in Diesel Engines. M. G. Fiedler. Experiments with Diesel type engines over a period of many years are reviewed and results of a series of tests on an engine designed by author are discussed. Various injection characteristics are indicated in a series of graphs. Continued. *Franklin Institute Journal*, January 1942, pages 17–39, 26 illus.

Carburetor Icing. A. N. Troshkin. Causes of carburetor icing and methods of preventing and removing ice formations are discussed at length. Among operating rules to avoid engine icing are: (1) be "ice-conscious" whenever temperature is 70°F. or below; (2) make certain intake air preheater is in proper working condition; (3) keep heat control at "full on" when atmospheric temperature is at 70°F. or less, or maintain a mixture temperature at not less than 35°F. or maintain intake air temperature at 75°F.; (4) with some engine installations available intake air heat may be greater than that necessary to prevent icing; (5) loss of power means loss in heat available for de-icing and ice prevention; (6) from icing standpoint it is inadvisable to operate at reduced throttle settings over prolonged periods when icing conditions exist; and (7) avoid flying through rain or overcast when temperature is at 70°F. or less, unless aircraft is equipped with adequate engine anti-icing or de-icing equipment. *Aero Digest*, January 1942, pages 160, 164, 252, 1 illus.

Fuel Injection for Aircraft Engines. P. M. Heldt. A discussion of both the principal engine types in use by the German Air Force. They are spark-ignition engines but use fuel injection. The fuel can be injected into either the carburetor, the manifold or the cylinders themselves. Usually the term "fuel injection" is applied to one of the two latter procedures. If the fuel is introduced directly into the cylinders, there is a nozzle for each cylinder and no distribution problem exists.

Oscar W. Schey has reported on the merits of fuel injection for aircraft engines, as the result of a thorough investigation made by the National Advisory Committee for Aeronautics. All military high-output airplane engines are supercharged; and if the fuel is introduced directly into the cylinder or just ahead of the inlet valve, the combustion chamber can be completely scavenged of combustion gases so that better cooling results besides the increase in engine output. Volumetric efficiency is said to be increased by this means.

Schey reported that he obtained a volumetric efficiency of 92.5 per cent with fuel injection and of 86 per cent with a carburetor, in the same engine at the same speed. There is no possibility of icing in the inlet tract because vaporization takes place in a region where the temperature is high. The equipment for injection is somewhat more expensive than a carburetor and is more complicated, particularly because in a spark-ignition engine the fuel and air charges should vary in the same proportion.

To provide for lubricating the injection pumps and nozzles, 0.5 per cent of a light oil was added to the fuel in the N.A.C.A. tests. Fuel is injected during the inlet stroke. The N.A.C.A. obtained best results by starting injection 60 crankshaft degrees after the beginning of the inlet stroke and allowing it to continue over 60–90 degrees of crank rotation.

A member of the Rolls-Royce technical staff, writing in *Flight* of Mar. 6, argued against there being any advantage in fuel injection over the use of a carburetor. He claimed that every disadvantage with which the carburetor has been charged could be counteracted by simple measures.

For instance, carburetor icing can be prevented by suitable heating; fire hazards due to back-firing through the carburetor can be removed by using induction pipe flame dampers; and such claims as that of better altitude performance and lower specific fuel consumption are not sustained when conditions such as speed, compression ratio, etc., are taken into account. The injection system involves far more parts, is much heavier and costs more to manufacture and maintain.

According to this writer, the rivalry between the two systems has undoubt-

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edly led to the benefits of progress. At their best there does not seem to be much to choose between them. *Automotive Industries*, September 1941, pages 6, 18–21.

Menasco Aids Air Corps Training. Joseph E. Babcock. A survey of the production methods by which Menasco builds their D4B 160 hp. air-cooled inverted in-line engines which are used to power several types of primary military trainers built in the United States and Canada. The article describes the structure, layout and equipment of the plant and the manufacturing process which turns out this well-known power plant. *American Machinist*, January 8, 1942, pages 20–25, 9 illus.

The Bristol Hercules. G. G. Smith. A detailed account of the constructional features of the 14-cylinder double-row air-cooled sleeve-valve radial Bristol Hercules III engine, developing 1,400 b.hp. for 1,850 lbs. weight. The engine is now in production in various Bristol and government shadow factories. With the low-speed supercharger in action, its climbing power is 1,170 b.hp. at 2,500 ft.; with the high-speed supercharger engaged, it is 1,090 b.hp. at 14,500 ft. Its maximum power for level flight with low speed supercharger is 1,425 b.hp. at 14,500 ft.; with the high-speed supercharger it is 1,270 b.hp. at 15,000 ft. Cylinder bore and stroke are 146 × 165 mm., giving total cubic capacity of 38.7 litres. Total weight of the engine is 1,850 lbs.

Development of the sleeve-valve Hercules began in 1927 with the testing of single-cylinder units. Drawing shows internal moving parts in addition to drives to one front and one rear sleeve. Illustrations demonstrate the working of the sleeve valve. *Flight*, November 27, 1941, pages 379–383, 7 illus. Also *Aircraft Production*, December 1941, page 92, 1 illus.; *The Aeroplane*, November 28, 1941, pages 599–601, 7 illus.

Rolls-Royce Merlin. A detailed description of the Rolls-Royce Merlin II engine. It is a 12-cylinder, supercharged, liquid-cooled type of engine employing ethylene glycol as a cooling medium. General figures are given on specifications and performance. *Canadian Aviation*, January 1942, pages 22–24, 31, 32, 6 illus.

Herculean Development. An account of the production of Bristol Hercules 14-cylinder two-row air-cooled motors as seen on a press tour of a shadow factory in northern England. Two major factors are noted—the excellent manner in which the engine lends itself to large-scale production, and the way in which comparatively unskilled labor can be used for the production of such precision machinery.

Layout of the plant divides production between four virtually self-contained shops: one is for cylinders and heads, sleeves, sleeve cranks, crankshafts and propeller shafts; another is for crank and reduction gear cases, supercharger casings and impellers, gear covers, bushes and studs; the third is for gears, spur and bevel, connecting rods, main drive, etc.; fitting and assembly are done in the fourth shop. Production procedure in each shop is described, showing both methods and flow of work. *The Aeroplane*, November 28, 1941, pages 599–601, 7 illus.

Flight Technique

How to Behave in Slow Flight. Wolfgang Langewiesche. An explanation of the dynamics and reactions to the airplane's controls in slow flight, this article is intended to aid the pilot in building up greater resistance to faulty reactions during a stall. *Air Facts*, January 1942, pages 28–41.

What Approach? William D. Strohmeier. The writer presents a new philosophy for forced landings indicating that they are now seldom, if ever, caused by outright motor failure due to the increased reliability of modern power plants, and that it is safer technique to make these advisory landings "power on" with sufficient flying speed rather than "power off" as the old fashioned training systems advised. *Air Facts*, January 1942, pages 17–21.

Range and Fuel Economy. C. L. Hinings. Conferential discussion of all articles on this subject published in new issues of *Flight*. This author maintains that flying at maximum lift-drag ratio gives greatest endurance but not the greatest range. *Flight*, December 11, 1941, pages 421, 422.

Fuels & Lubricants

Prediction of Octane Numbers and Lead Susceptibilities of Gasoline Blends. D. Eastman. Methods for prediction of octane numbers and lead response characteristics of gasoline blends are presented. Octane numbers are predicted by means of a blending coefficient which has been correlated with the difference in octane sensitivity between the stocks blended. Modification of the Hebl, Rendel, and Garton chart is presented for evaluation of lead response, and correlations for prediction of this factor from sulphur content and octane sensitivity are given. Methods for prediction of lead response to blends are described. *Industrial & Engineering Chemistry*, December 1941, pages 1555–1560, 4 illus.

Gliding and Soaring

The Glider's Part in an Air-Borne Invasion. Germany is building large numbers of big gliders which can have only one purpose—the transport of light tanks, men and supplies for mechanized forces. Transport airplanes, such as the Junkers Ju.52/3m, can tow a glider big enough to double the useful load of the tug. Bombers such as the Heinkel He.111K and Focke-Wulf Kurier are capable of towing very heavy gliders.

A glider with a span of 80 ft., wing area of 800 sq.ft. and an empty weight of about 3,000 lbs. could carry something like 5,000 lbs. of disposable load. All that is useful load because there is no fuel to stow except in the case of a motor-assisted glider, which is another possibility. Such a glider is small. An air trailer of twice that size is not only a possibility, but almost a certainty. With a span of 160 ft. a glider could carry something like 20,000 lbs. of useful load—a light tank of fair hitting power, if built for the job. An even bigger glider is fully practical although a big target in the air or on the ground. For instance, a glider of 200 ft. span could be built to lift more than 35,000 lbs. (15½ tons) of useful load and could be towed by existing bombers without difficulty.

Reports from Stockholm indicate that glider production is going on on a large scale in Germany. Gliders towed behind Ju.52's have been used to bring up supplies from Crete and Greece to the Axis forces in Libya. Although a tremendous loss of life was involved, the battle of Crete showed that when enough transports can be crash-landed within a small radius the threat develops rapidly. Strength of the Fighter Command is best insurance against enemy success. Specialized "tank buster" airplanes are needed to deal with mechanized forces which do land. *Aeroplane Spotter*, December 4, 1941, page 229.

High-Altitude Flying

Pressure Cabins and Temperatures. H. M. J. Kittelsen. A discussion of the methods by which the cabin and wall temperatures can be investigated and the consequent deductions made for any pressure cabin aircraft generally. A fictitious airplane serves the basis of consideration, but details on the assumed pressured circuit are omitted.

Calculations are based on the geometry of the pressure cabin, the cruising speed of the aircraft at all altitudes and the supercharger delivery temperature, pressure and cabin air mass flow at all altitudes. *Aircraft Engineering*, November 1941, pages 303–305, 4 illus.

Higher Flying. An article on the Collier trophy awarded for 1940, and the achievement of Dr. Sanford A. Moss, scientist, and the army air corps who jointly won the award for "outstanding success in high altitude flying by the development of the turbo-supercharger." *National Aeronautics*, January 1942, page 15.

History

Aviation "Firsts" in California. Leonard E. Read and Glen B. Eastburn. A review of aviation "firsts" which have taken place in California, this article notes events and circumstances surrounding the pioneering activities in California of many personalities and organizations who are today leaders in aviation. *Aero Digest*, January 1942, pages 97, 98, 100, 102, 104, 17 illus.

Flying the Early Air Mail Planes. Lieut. Christy C. Cole. A personalized description of the work of flying air mail in the early days of air mail planes. *U.S. Air Services*, December 1941, pages 17, 40, 1 illus.

Flying as It Was. Joy Bright Hancock and Earl Burton. The history of the Naval Air Station at Pensacola, Florida, which began as a Naval Base in 1824, lived an adventurous career through the Civil War and fell into disuse with the decline of wooden ships, only to be rejuvenated in 1914 as an aviation center for the Navy. The selection, development and use of this location during the period preceding the first World War is related. *The Sportsman Pilot*, January 1942, ages 16, 17, 30, 32, 34, 35, 6 illus.

The Marines. Col. Ralph J. Mitchell. A history of the service of the aviation branch of the United States Marine Corps beginning with its inception in 1913. The review treats of its service during the war and its many records of distinction in the less spectacular yet politically important periods in the nation's history in Haiti, San Domingo and Nicaragua.

The administrative structure of the marine corps division is described along with the type of personnel it has attracted and some of the newer tasks which have been assigned to it in the modern scheme of air warfare. *Flying and Popular Aviation*, January 1942, pages 86–90, 244, 13 illus.

Hydraulics

Hydraulic System Installations. Part 3. James E. Thompson and Rodney B. Campbell. The third in this series, this article discusses the control and actuating circuits used in hydraulic installations. Design and function are treated with elementary explanation of operative principles. *Aero Digest*, January 1942, pages 136, 140, 142, 145, 248, 9 illus.

A view of templates being cut from sensitized metal on which original drawings of designs for airplane parts have been photographed. This is one of the steps in the photo-lofting system developed at The Glenn L. Martin Company.

Aircraft Hydraulic Pumps. Lieut. Harry J. Marx and Edward M. Greer. A third in the series on aircraft hydraulic mechanisms, this installment studies the characteristics and uses of advance types of piston pumps used in aircraft including the hand pump, various types of crankshaft-operated pumps, rotary radial pumps, rotary axial pumps, and swash plate pumps. *Aviation*, January 1942, pages 96, 97, 214, 5 illus.

Inspection

X-Ray Inspection and Supplementary Technique. H. M. Muncheryan. A study of the industrial applications of the X-ray technique indicating the use to which X-ray inspection has been put in the non-discovery examination of aircraft materials. The writer states that while X-ray examination is not a panacea for material maladies it does offer a more extensive insight to the causes and detection of material failure and does give designing engineers and foundry personnel aid in improving both the quality of their products and the techniques by which they are made. *Aviation*, January 1942, pages 184, 186, 4 illus.

Alignment of Cellulose Strands Is Key to Cotton Fiber Strength. A new test method using an X-ray "eye" to look inside cotton fibers has been developed by U.S. Dept. of Agriculture scientists. The direction of spiral of any one layer of crystalline cellulose strands is reversed several times along the length of fiber. Because of spiral twist of cellulose strands, crystals are aligned at variable angles to longitudinal axis of fibers. Tests demonstrate that the more nearly parallel strands are to long axis of fiber, the stronger is the cotton. A brief account is given of test procedure which begins when X-ray unit makes photographic diffraction pattern of a bundle of cotton fibers. *Franklin Institute Journal*, December 1941, pages 603, 604.

Instruments

A Medium High Frequency Visual Ground Direction Finder. David S. Little. Details on a medium high frequency visual ground finder apparatus suitable for use in taking bearings on domestic air carrier craft. The apparatus is the result of development work recently completed by Western Electric Company. *Aero Digest*, January 1942, pages 70, 73, 307, 7 illus.

A New Precision Refractometer. J. V. Hughes. A refractometer capable of giving refractive indices and dispersions to one unit in the fifth decimal place is described. Samples are smooth ground, but not polished, and require little care in preparation. Complete determination (Na D, C, and F lines) can be made in one-half hour. This compares favorably with the Pulfrich refractometer, both for accuracy and for speed, particularly if the time of preparation of a specimen

is taken into account. *Journal of Scientific Instruments*, December 1941, pages 234–237, 3 illus.

Jet Propulsion

Jet Propulsion of Aircraft. G. G. Smith. Additional details on Italian experiments. A photograph of Campini's jet propelled aircraft, flown for a ten-minute period from the Forlanini Aerodrome in August 1940, indicates a radical change from the original design, shown in a sectional drawing.

The pilot is apparently accommodated in a cockpit between the wings, and not in the nose of the fuselage, as in the original plan. A low-wing monoplane with two seats in tandem is now preferred, with curious heavy-looking wing roots and undercarriage with legs retracting outwardly, whereas the nine-year-old layout, proposed by S. Campini in 1932, was for a high-wing monoplane of entirely different form. Airstream is now taken in through a circular opening in the front of the fuselage instead of through the annular space between the pressure-charged cabin and the enshrouding fuselage as in the original design.

From the bare particulars revealed on the new type, it is learned that at low altitudes the air is subjected to an initial compression by the forward motion of the aircraft. The air is additionally compressed by means of a blower driven by the engine, which may be a nine-cylinder radial type, as on the early design; or, possibly a turbine is referred to. To utilize latent heat of the fuel, exhaust of the engine discharges directly into the main airstream, adding heat and still further increasing pressure of the air. For high-altitude flight at high speeds, a further supply of fuel, introduced through supplementary burners, may be utilized to furnish additional heat. In this manner, mass and velocity of the jet, and consequently the thrust are increased.

Airstream is controlled by the pilot by means of a cone on the end of a shaft which is arranged to slide longitudinally. This cone has the effect of varying the cross-sectional area of the jet orifice, and thereby the speed of the propulsive jet. Tail end of the fuselage is exceptionally large in diameter, in order to accommodate this feature, which presumably follows the previous scheme illustrated in the sectional drawing. *Flight*, December 4, 1941, page 400c, 2 illus.

Maintenance

Chicago and Southern's Base. A description of Chicago and Southern Air Lines' main overhauling base at Memphis, Tennessee, describing the methods and equipment used by the personnel in the line's operation. The article also contains a brief history of the technical developments of the line and explains some of the special equipment which Chicago and Southern's engineers and maintenance chiefs have designed to accelerate service. *Aviation*, January 1942, pages 108, 110, 113, 196, 15 illus.

Green Field. C. R. Mooney. An account of the repair service afforded by a fixed-base operator who believes the rarest thing on earth as far as the private flier is concerned is satisfactory service at a reasonable cost. *Southern Flight*, December 1941, pages 36, 40, 5 illus.

Autobiography of a Cyclone. David Leigh. The maintenance biography of a Wright cyclone aircraft engine used on an air transport is told in the first person, as if by the engine itself. *Airlanes*, December 1941, pages 14, 15, 19, 4 illus.

Management

They Could be Smart. William Flynn. Many small, commercial operators adopt a rather foolish attitude in public relations, according to this article. Lacking information on proper relations toward their local newspapers, they tend in many cases to treat their local reporters unintelligently when minor accidents occur.

This article explains a newspaperman's view toward the local commercial charter and flying school operator and lays down basic principles for better public relations for those persons in aviation to whom the services of a professional public relations counsel would be impractical. *Air Facts*, January 1942, pages 22–27, 3 illus.

"Freezing" Aircraft Design. Brief account of a discussion before the Detroit Section, S.A.E., on the possibility of permanently fixing designs of military airplanes to facilitate mass production. Frozen design leads to frozen thinking and that leads to destruction, it was said.

The object of attempts to freeze design is to get a steady flow of airplanes from production lines with a minimum of change, he stated. If design changes, as they are found necessary, are saved up and all put into effect at once, it generally means that production must come to a stop. There follows a period when much inertia must be overcome to get production lines moving again.

A better goal is the steady flow of airplanes with little change between each plane. It is inferred that this goal is most easily attained by "working in" changes from day to day. *S.A.E. Journal*, January 1942, page 22.

Manufacturers of Parts Well Organized for Wartime Operation. Lee Cameron. An outline of the closely-knit organization of parts manufacturers who are cooperating in the contribution of parts and components to the aircraft industry war effort. *Aero Digest*, January 1942, pages 82, 104, 1 illus.

Plant Management Problems. Lester Benson. The works manager of Bell Aircraft Corporation discusses his views on efficient aircraft plant organization and direction in a summary on production, engineering, design and control and their relation to management. *Canadian Aviation*, January 1942, pages 37, 38, 41, 56, 2 illus.

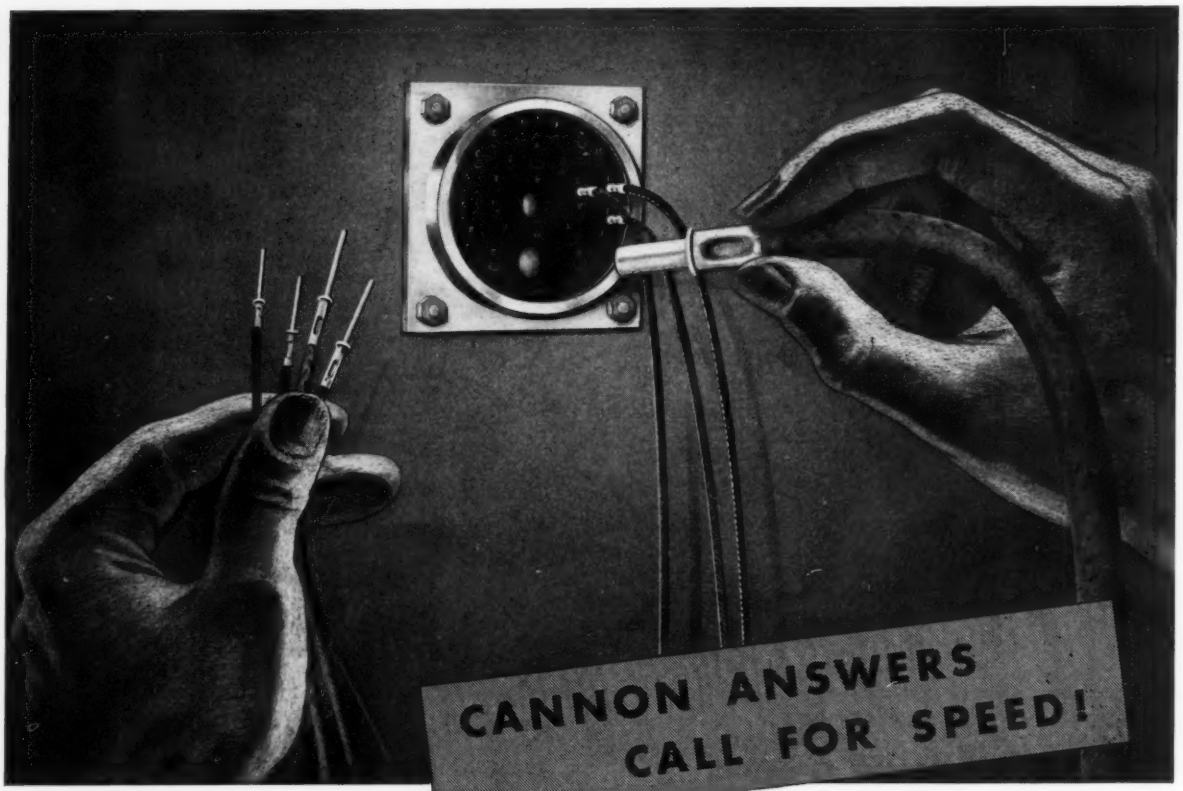
Efficient Use of Labor Memorandum Subject. A summary of a report by the War Emergency Committee of the Institute of Production Engineers in England, dealing with the efficient utilization of labor under war conditions, with special emphasis on the subdivision of operations and upgrading to compensate for shortage of skill. *Canadian Aviation*, December 1941, page 64, 1 illus.

Materials

Roller Bearings and National Defense. T. V. Buckwalter. A brief discussion of the introduction of tapered roller bearings into all phases of industry, manufacturing, and transportation during past two decades precedes an analysis of design principles. One of the fundamental concepts of tapered roller bearing usage is that they must be mounted in pairs; a second is that the bearings accommodate any combination of thrust and load.

For high thrust reactions, the bearing is made with a steep taper. Tapered roller bearings are rated in accordance with a speed factor, life factor, and application factor, and it is explained how each of these factors is derived. Also discussed are lubrication, extreme-pressure lubricants, lubricant testing, types of tapered roller bearings, contact stresses in solid and hollow rollers, crankshaft and crankpin applications. *S.A.E. Journal*, January 1942, pages 20–36, 33 illus.

Wings and Trees. Joseph N. Hessel. A description of the types of wood available in the United States for the manufacture of plastic-bonded aircraft fuselage and wings. The supply of Sitka spruce is especially noted. *National Aeronautics*, January 1942, pages 22, 23, 31, 5 illus.



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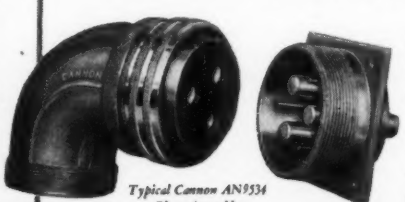

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Medicine

Investigations Concerned with Problems of High Altitude Flying and Deep Diving. Lieut. Comm. Albert R. Behnke, Jr. This article was the Sir Henry Wellcome Prize Essay for 1941. In effect, it summarizes medical investigations reported to date on problems of high altitude flying, and interprets the application of their findings to the general military service.

Among the problems discussed are symptoms arising from rapid changes in barometric pressure involved in ascent to high altitudes, the problem of aeroembolism and the problems of work at high altitudes. Experimental results in these fields are reviewed, and procedures and standards for testing and maintenance of fitness for high altitude flying are outlined. *The Military Surgeon*, January 1942, pages 9–29, 3 illus.

The Value of the Pseudo-Isochromatic Color Vision Test in Original Applicants for Military Flying. Maj. M. S. White. A brief presentation of the results of an investigation on the color vision test used for examination of applicants for military flying. Conclusions derived from the study are given:

Individuals color deficient as revealed on the Ishihara plates, but able to select gross shades of red and green, were shown to be deficient in three of the main requirements of a military pilot with reference to color vision—namely, recognition of Very pistol Signals, Navigation Lights, and map color shades. Failure on the Ishihara Test or a modified similar Pseudo-Isochromatic plate test should be considered disqualifying for original applicants in military aviation. *The Military Surgeon*, November 1941, pages 801–805.

The Naval Flight Surgeon. Capt. J. R. Poppen. An explanation of the function of the flight surgeon in selecting the proper material for the Navy's flight personnel and in keeping them in the peak of physical condition during their active careers. The various tests in the selection of these men and the routine in the maintaining of physical fitness is explained. *Flying and Popular Aviation*, January 1942, pages 91–93, 7 illus.

Metallurgy

Mining and Aircraft Production. Robert Linton. A consultant in mining and industrial engineering examines in this article the place of mining and metals in today's aircraft production picture and outlines the role of rarest metals and alloys in the materials phase of aircraft design and production. *Aero Digest*, January 1942, pages 134, 308, 310, 1 illus.

Metal Pickling with Ferric Sulfate. J. O. Percival, C. P. Dyer and M. H. Taylor. Ferric sulfate is being used commercially for descaling stainless steel and copper alloys, for brightening copper alloys, for increasing adhesion of protective coatings to steel, and for other applications which depend on its oxidizing action. In most cases ferric sulfate gives results equal or superior to comparable techniques and is less expensive to use. The rise of ferric sulfate to its present position in the metal pickling field is described, practical industrial operating details are given, and results are compared with other procedures. *Industrial and Engineering Chemistry*, December 1941, pages 1529–1535, 8 illus.

Anodic Treatment of Aluminum in the Chromic Acid Bath. O. F. Tarr, Marc Darrin, and L. G. Tubbs. Chromic acid has extensive uses in the anodic treatment of aluminum for all U.S. Naval aircraft. It is said that uncertain and inefficient operation has resulted in many instances from lack of data regarding the factors influencing the process.

This report presents fundamental data showing the relationship between corrosion resistance, film weight and thickness, current density, concentration of pH of the chromic acid bath, temperature, time of treatment, electrical and practical efficiencies, chromic acid economy, alumina dissolved, cathode area, throwing power, etc., in the treatment of aluminum and some of its alloys.

From the data given it is possible to calculate the most economical procedures which will give satisfactory films under various operating conditions. *Industrial and Engineering Chemistry*, December 1941, pages 1575–1580, 7 illus.

Effect of Shot Blasting on Strength of Metals. J. M. Lessells and W. M. Murray. Considerable increase in fatigue life and endurance limits of steels can under certain conditions be obtained by shot blasting the surface. By inference, similar advantages may be gained for metals other than steel.

Increase in fatigue life and endurance limits seems to be due to a cold working of outer surface although resulting compressive stress may be beneficial. There does not appear to be any advantage as regards endurance limits in shot blasting surfaces where high residual stresses due to quenching and insufficient drawing are present.

Beneficial effects can be removed by annealing, but annealing at low temperatures, provided this is not sufficiently high, is beneficial as regards fatigue life for shot-blasted surface. *Heat Treating & Forging*, November 1941, pages 557, 558, 567, 568, 7 tables.

Production Metallizing. H. E. Linsley. An explanation of the metallizing processes for protecting the exterior surfaces of aluminum alloy aircraft engine components from corrosion due to exposure to the elements. The method involves the spraying on the parts of pure molten aluminum which is itself highly resistant to corrosion. The procedure involved in this operation is described in detail. *Aero Digest*, January 1942, pages 154, 159, 248, 249, 6 illus.

Cylindrical Surface Hardening. J. G. McGrath. Flame-hardening of shafts, rolls, cylinders, liners, sleeves both inside and outside, by the circular band progressive method, is described in detail and an explanation is given of the alternate processes that may be employed. *American Machinist*, December 24, 1941, pages 1317–1319, 7 illus.

Beryllium Alloys in Aviation. E. Burke Wilford. A study of the characteristics of an experimental beryllium-aluminum alloy suitable for engine forgings and aircraft parts. The article outlines the characteristics and availability of the basic metal and indicates the weight-saving possibilities of "Berial," the suggested alloy. *Aviation*, January 1942, pages 92, 93, 188, 3 illus.

Calcium in Lead-Calcium Alloys. E. E. Schumacher and G. M. Bouton. A method is described for estimating calcium in lead which consists of casting a test ingot in a prescribed manner and comparing its surface appearance with the surface appearance of standards. Calcium content can be determined by inspection. Photos and drawing show apparatus used in casting lead-calcium ingots under controlled atmospheres, and apparatus used for regulating atmosphere composition. *Metals & Alloys*, December 1941, pages 865–867, 3 illus.

Flow and Rupture of Metals. Part III. G. Sachs. This installment discusses speed and impact effects; the probable future development of knowledge of plastic deformation and rupture of metals is considered. Illustrations show: diagrammatic representations of effects of contact length and friction in forging; effects of contact length in drawing on properties of product, diagrammatic representations of effect of impact on strain and stress in upsetting, and of effects of tool

design and speed in working on force-stroke diagram in deep drawing. *Heat Treating & Forging*, November 1941, pages 565–567, 4 illus.

Du Pont Cyanide Service Laboratory. A new laboratory at the Niagara Falls, N. Y., plant of the R. & H. Chemicals Dept., used principally for development of improved metal treatment, and electroplating processes. The metal treatment section has a chemical laboratory to analyze case-hardening baths and heat-treating compositions as well as treated metals. A metallographic preparation room has equipment for sectioning and polishing metals, and Brinell, Firth Hardometer, Rockwell, Rockwell superficial, and Scleroscope machines are used to determine hardness of treated test pieces of metal. Investigation of methods for removal of salts which form on sheet steel during pickling operations is one of the interesting studies continued in the new laboratory. *Industrial and Engineering Chemistry* (News Edition), December 10, 1941, page 1402.

S.A.E. Standard Procedure Recommended for Testing Hardenability of Steel. To fill the need for a standard procedure for hardenability testing and a standard system for denoting hardenability of steel, the Iron and Steel Division of the S.A.E. Standards Committee has recommended the Jominy End-Quench Test as the standard of testing hardenability, and that hardenability be expressed in terms of distance from the quenched end to which a certain hardening occurs. For the purpose of predicting the hardening characteristics of steel in various-sized sections, hardness data obtained from the end-quenched hardenability test bar is plotted against cooling rates and compared with a chart showing cooling rates from surface to center of various-sized sections.

Procedure prescribed for conducting the hardenability test and for recording the results to conform with the S.A.E. recommended practice is included in this article. Also included are standard charts for plotting hardenability test results and for predicting hardness U-curves in various-sized rounds. *S.A.E. Journal*, January 1942, pages 15–20, 44, 10 illus.

The Drawability of Deep Drawing Sheets. M. Asimow and J. N. Crombie. Although many tests have been devised in an effort to evaluate deep drawing qualities of metals, results either cannot be well correlated or do not predict results which may be expected in practical drawing with a real degree of certainty.

Certain aspects which mitigate against the reliability of test procedures are clarified in this paper, and attention drawn to some factors affecting drawability which have received little consideration. A bibliography, covering plasticity and cold deformation, is appended. *Heat Treating & Forging*, December 1941, pages 617–619, 2 illus.

Induction Surface Hardening. H. B. Osborn, Jr. Induction hardening permits surface hardening of only the requisite portion of most any steel object. It thus maintains original ductility and strength; hardens articles of intricate design which cannot be feasibly treated in any other way; eliminates usual expensive pretreatment such as copper plating and carburizing, and costly subsequent straightening and cleaning operations; cuts down material cost by affording a wide selection of steels from which to choose; and hardens a fully machined item without necessity of any finishing operation.

Equipment used and a variety of articles treated by induction hardening process are illustrated. Curves are plotted for maximum hardness obtainable for varying carbon content in some 40 specimens of steel. *Heat Treating & Forging*, December 1941, pages 610–612, 621–623, 7 illus.

Meteorology

Storing Weather Data. A. B. Westcott. Climatological data gathered by the U.S. Weather Bureau over a period of more than 50 years is being translated into usable form as an aid to military authorities in national defense. The objectives of such information and the methods being used in its development are described. *Western Flying*, December 1941, pages 37, 40, 2 illus.

The Transmission of Light in the Atmosphere with Applications to Aviation. Henry G. Houghton. Introducing this paper with the observation that the transmission of light through the atmosphere is determined by the absorption and scattering which it suffers, the writer shows that absorption is negligible in the visible spectrum but becomes increasingly strong in the infrared. Scattering is due to suspended particles ranging in size from the air molecules to rain drops. The scattering coefficient changes with the wave length or color of the light only when the scattering particles are smaller than the wave length.

Since the suspensoids which produce low visibility are large compared to the wave length of visible light and the near infrared, no advantage results from the use of colored lights or the infrared in such cases. Photography in the near infrared is useful in cases when the visibility is limited by small particle haze.

Theory shows that the visual range is determined largely by scattering coefficient of the atmosphere. Since it is often difficult to select suitable marks for the estimation of the visual range, it is suggested that an instrument be developed for determining the scattering coefficient. *Journal of the Aeronautical Sciences*, January 1942, pages 103–107, 1 illus.

Graphical Method of Evaluating Pilot-Balloon Ascents. L. W. Pollak. An account of a simple plotting equipment for pilot-balloon ascents which can be used for both tail and non-tail ascents. Using this equipment, it has been found possible to derive results so rapidly that the determination of the wind velocity and direction can be kept up to date from minute to minute as the balloon is followed. Accuracy is equal to that obtained with a slide rule 20 in. long, use of which, however, involves many arithmetical processes by which possibility of error is increased. *Bulletin of the American Meteorological Society*, November 1941, pages 345–348, 1 illus.

Clouds in Aerology and Forecasting. C. F. Brooks. The first in a series of papers on texture, forms and internal or general motions of clouds as a valuable aid in the interpretation of the aerological condition of the atmosphere. This discussion covers cloud shape and lapse rate, and cloud motion and wind. *Bulletin of the American Meteorological Society*, November 1941, pages 335–345, 6 illus.

The Measurement of Visibility. Matthew Luckiesh and Frank K. Moss. In this paper certain fundamental principles involved in the measurement of visibility are discussed in relation to the use of the Luckiesh-Moss visibility meter. The construction, calibration and operation of this instrument are described. In view of the variety of visual problems in the aeronautical sciences and practices the present discussion is directed to general rather than specific techniques for investigating individual problems. *Journal of the Aeronautical Sciences*, January 1942, pages 100–102, 3 illus.

Causes and Forecasting of Low Ceilings and Fogs at Houston, Tex. J. W. Bowdoin. Data are presented regarding ceilings and fogs noted during different periods of the year at Houston Airport, located 35 miles north-northwest of the Gulf of Mexico, 10 miles west of Galveston Bay, and 53 ft. above sea level.

Curves show average number of hours fog reduced visibility to one mile or less by months. Fog graphs for tropical maritime air and transitional polar air are presented, as well

as graphs showing relation of gradient winds to ceilings for winter months and fog graph for April. From May 20 to Oct. 5 there were no cases of fog at Houston serious enough to interrupt air line schedules. *Bulletin of the American Meteorological Society*, November 1941, pages 351–357, 5 illus.

Military Aviation

Interceptor Command. E. E. Holmes, Jr. A description of the facilities and equipment at Mitchell Field, base of the first interceptor command responsible for defense of the northeastern quarter of the United States. The article describes the housing facilities, personnel, equipment and responsibilities of the group. *Aviation*, January 1942, pages 132, 135, 182, 5 illus.

Rebirth of the R.A.F. An article written in England concerning the progress of British air strength since the war began and the work of the various commands and organizations which has been greatly intensified to achieve the final victory. The revised structure of the air command is outlined. *Aviation*, January 1942, pages 136, 137, 220, 2 illus.

Lancio di Bombe in Serie da Aerei a Velocita Decrescente e a Quota Costante Contro Bersagli Fissi o Mobili con Velcoita Costante (Dropping Bombs in Succession from an Airplane Which Flies at Decreased Speed at Constant Altitude, on Stationary Targets or on Targets Which Move at Constant Speed). Andrea Tommasi. If bombs are to be dropped in succession from such an airplane on stationary or mobile targets, consideration has to be given to the variation of speed and altitude of the airplane, so that the various bombs which are to be released at various altitudes and speeds are going to hit said targets.

This article reports an investigation of the special case of releasing bombs at constant altitude, and application of the law to which the motion of the airplane must comply in order to reach said objective. Also discussed is the possibility of determining by actual tests whether the airplane follows the law of determined motion. *L'Aerotecnica*, September-October, 1941, pages 615–630.

'Ware Gas! Citing a recent item in *Der Adler*, organ of the Reichs Luftfahrt Ministerium, this article draws attention to German experiments with the release of chemicals from airplanes and to the possible methods that might be used by Germany in spraying poison gases from the air as a part of its military strategy. *The Aeroplane*, December 19, 1941, page 675, 4 illus.

Policy, Not Strategy, Controls Our Bombing. Capt. Norman MacMillan. Taking sight on Axis controlled territories and operations as opposed to those of the Allies, the columnist attempts to explain the points at which two groups vary—those who advocate direct bombing of strategic enemy objectives, and those who favor mass bombing to break enemy morale. Describing the objective of the enemy as the conquest of territories as opposed to the Allied objective of restoring the *status quo ante bellum* territorially, he points to a necessity for a difference in tactics. He urges unrestricted use of bombers against the German, Japanese and Italian people themselves in the effort to break their morale. It is the complete loss of morale, he says, which prostrated Germany at the close of the first World War. *The Aeroplane*, December 19, 1941, pages 665, 666, 2 illus.

Stora Eller Sma Bomber (Large or Small Bombers)? Ingemar Schwalbe. A mathematical study of both bomber types, this article finds the large bomber more advantageous tactically. *Flyg och Motor* (*Technical Supplement*) *Flygning*, October 1941, page VI.

Cable Fenders for Airplanes. Antiballoon barrage "fenders" are now being fitted to German bombers. British bombers use a form of cable cutter. The German device weighs between 600 and 800 lbs., and is said to reduce maximum speed of the bombers by 20 m.p.h. *Aeroplane*, November 21, 1941, page 556.

Writer's Cramp Squadron. Bill Voigt. An account of the clerical forces of "pencil pushers" who behind the scenes organize operation reports and coordinate all the minutia of detail connected with developing data for effective military air operations. *U.S. Air Services*, December 1941, pages 11, 12, 40, 1 illus.

The 4th Air Force in California. Maj. Gen. Jacob E. Fickel. An outline of the Air Forces' air defense organization in California, with brief notes on the major air bases. *Aero Digest*, January 1942, pages 78, 249, 250, 2 illus.

Here Come the Grasshoppers. Notes on the factors which adapt lightplanes to modern military warfare tactics. *National Aeronautics*, December 1941, pages 11, 22, 1 illus.

Pacific Battle Ground. Lynn C. Thomas. A former newspaperman in the Far East recalls, in the light of Japan's attack in the Pacific, a variety of facts regarding Japanese military aviation in that vicinity as observed by the writer during the last several years. *Western Flying*, January 1942, pages 23–25, 5 illus.

The New Air Tactics. The Hawker Hurricane, redesigned as a fighter-bomber, has injected new air tactics according to the article which indicates that the high-speed day bomber is a practical weapon, for low-level surprise bomb attacks. The technique used in the adaptability of the new Hurricane type for this job is described. *The Aeroplane*, November 28, 1941, pages 589, 590, 4 illus.

Naval Aviation

Our Air Corsairs—I, II. A descriptive analysis of air operations against enemy shipping in the present war, particularly in contrast to corresponding operations during the first World War. Improved equipment and tactics are pointed out together with an interpretation of specific phases of such air operations. *The Aeroplane*, December 5, 1941, pages 609–611, 2 illus.; December 12, 1941, pages 648, 649, 4 illus.

CV—The Carrier. Vice Adm. William F. Halsey. The Commander of Carrier Division Two outlines the history of carrier aircraft from the original take-offs and landings by Eugene Ely from the decks of the U.S. *Birmingham* and *Pennsylvania* in 1910 through the converted *Collier Langley*, *Lexington*, *Saratoga* and the most modern carriers recently commissioned. The function of the carrier as a unit of the modern fighting fleet is explained and life aboard the carrier is described. *Flying and Popular Aviation*, January 1942, pages 115–120, 164, 18 illus.

The Battleship Yields. T. Benson Hoy. A discussion of the importance of air power to America's armed forces operating abroad. Commenting on the awakening of the British Navy to the menace of air power, the writer sums up the Japanese attack in the Pacific in the suggestion that it is now our Navy's turn. Conclusions are drawn to the effect that battleship strategy is outmoded and that British Naval losses have shown that "while the plane versus battleship controversy as such is not ended, the reign of the battleship is." *Western Flying*, January 1942, pages 20–22, 54, 6 illus.

Air Power versus Sea Power. Analyzing this "inevitable" controversy, this editorial discusses its development from the first World War, points up the considerations on both sides, finding air power the ultimately deciding factor in the present conflict. The conclusion is based largely on the

success of torpedo bombers as experienced in current war. *The Aeroplane*, December 19, 1941, page 668.

VJ—The Utility Plane. Comm. C. T. Durgin. A study of the "work horse" of Naval aviation—the various types of utility craft which act as aerial cargo carriers for the Navy. Notes are given on the highly diversified types of work which this branch must perform and the various kinds of aircraft used by this wing. *Flying and Popular Aviation*, January 1942, pages 76–78, 246, 11 illus.

VOS VSO Observation and Scouting. Lieut. Comm. M. K. Fleming, Jr. An explanation of the widely diversified function and types of observation and scouting craft used by the Navy since 1911. Descriptions of some of the modern types of scouting and observation craft are also given. *Flying and Popular Aviation*, January 1942, pages 72–75, 252, 11 illus.

VSB—The Scout Bomber. Lieut. Comm. J. N. Murphy. A history and description of various types of scout and dive bombers used by the Navy since 1920 and an explanation of their function in modern naval warfare. *Flying and Popular Aviation*, January 1942, pages 68–70, 192, 10 illus.

VT—The Torpedo Plane. Lieut. Comm. Steadman Teller. A study of the increased military importance of the United States torpedo bomber types in the light of such military victories as Cape Matapan and the sinking of the *Bismarck*. The article describes briefly all of the Navy's torpedo types from the Curtiss R-6, built in 1917, to the modern *Douglas Devastator*. A general outline of the Naval operations of this type is also included. *Flying and Popular Aviation*, January 1942, pages 63–66, 224, 7 illus.

VF—The Fighter. Lieut. Comm. John B. Pearson, Jr. This historical and descriptive review of the U.S. Navy's fighter types since World War days indicates their function, particularly from the viewpoint of carrier-based bomber types. *Flying and Popular Aviation*, January 1942, pages 58–62, 218, 18 illus.

The Bureau of Aeronautics. Rear Adm. John H. Towers. The Chief of the Bureau of Aeronautics explains the structure of this arm of the U.S. Navy and its relation to the entire problem of Naval defense. *Flying and Popular Aviation*, January 1942, pages 34, 182, 3 illus.

VPB—The Patrol Bomber. Rear Adm. John S. McCain. The Commander of the Aircraft Scouting Force of the U.S. Fleet relates the history, function and development of the United States Navy patrol bomber type explaining its exact function in modern naval warfare. Approximate descriptions of the various individual designs which have been adapted since 1916 are given. *Flying and Popular Aviation*, January 1942, pages 51–56, 12 illus.

Lighter-Than-Air. Comm. S. E. Peck. The head of the Air Ship Division of the Navy's Bureau of Aeronautics relates the history of balloons and powered lighter-than-air craft in the U.S. Navy. The article also explains in detail some of the most modern uses of blimps and balloons which are chiefly employed at present to spot enemy submarines and, as in the case of the barrage balloons, to actually hamper enemy bombers. *Flying and Popular Aviation*, January 1942, pages 94–98, 13 illus.

The History of Naval Aviation. Joy Bright Hancock. A condensed history of naval aviation beginning with the original demonstration at Ft. Meyers in September of 1908. The article reviews experiments in deck take-offs on the naval vessels, *Birmingham* and *Pennsylvania*, and the further development of aviation as a part of modern naval warfare through the first World War and up to the present day. *Flying and Popular Aviation*, January 1942, pages 30–33, 218, 13 illus.

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Equitable Fire & Marine Insurance Co.
Granite State Fire Insurance Co.
Mercury Insurance Co.
Michigan Fire & Marine Insurance Co.
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Personalities

Who's Who in Production. Brief pen pictures of leading personalities in the manufacture of British aircraft, including Comm. Sir Chas. Craven, W. E. Rootes, P. Pritchard, Bernard Hopps, Maj. H. R. Kilner, and H. J. Pollard. *Aircraft Production*, December 1941, pages 74, 75, 6 illus.

La Motte Cohu. An outline of the aviation career of La Motte T. Cohu, chairman of the board of directors of Northrop Aircraft, Inc. *Western Flying*, December 1941, page 34, 1 illus.

A Founder of the Luftwaffe. A biographical note on General Helmuth Wilberg who was killed in an air accident in the same week as Ernst Udet. Wilberg was not only founder of the present Luftwaffe, but had an important role in the building of the Imperial Luftwaffe of 1914–1918. *The Aeroplane*, December 5, 1941, page 623, 2 illus.

Off the Ground Most of the Time. A brief biography of Roger Wolfe Kahn and his contribution to aviation since 1927. *U.S. Air Services*, January 1942, pages 36, 38, 1 illus.

Plants

Wings for the Kangaroo. David W. Bailey. An account of the creation of the Commonwealth Aircraft Corp. plant in Australia under the direction of Lawrence J. Wackett, and its development from an assembly station for trainers to an independent production unit capable of building enough aircraft to be an important factor in Pacific defense. *Air Trails*, January 1942, pages 10, 11, 40, 42, 6 illus.

Production without Frills. A brief description of the production flow at a new North American Aviation factory, the actual physical construction of which was completed in 120 days. Production achievements are not revealed, but it is said that the plant's manufacturing record is close to that of the construction job by which it was erected. *Southern Flight*, December 1941, pages 16, 17, 3 illus.

Intercontinent Shows $5,000,000 Backlog. G. Ralph Kiel. A description of a defense plant which is doing subcontracting ordnance and airplane manufacture, and shows a $5,000,000 backlog only 6 months since completion of the plant. *Southern Flight*, December 1941, pages 38, 39, 42, 7 illus.

Planned Progress. William Stark. The planning and organized efforts which have brought North American through its various stages of progress from the successor to General Aviation Manufacturing Corporation, with its 100 employees, to its present payroll of 21,000 persons are described in this article which points out the successive stages in the company's development and notes the current position of its plant space, equipment and facilities. *Western Flying*, December 1941, pages 64, 68, 76, 10 illus.

Planning Layout of Plants. Harry Wilkin Perry. An account of organization at the Douglas Aircraft Company plants, this article describes the system which has enabled the company to nearly double bomber production. The straight line flow layout and the scheduled movement of parts and components through production in assembly lines are discussed. *Aircraft Production*, December 1941, pages 103–106, 6 illus.

The Thermometer Nose Dives. A. R. Boone. Brief description of Douglas Aircraft Company's new cold room completed at one of the company's plants. At intervals thermometer sinks to 104 degrees below zero in the scientific ice box, which measures 8 × 14 × 16 ft. Insulation is effected by 12 inches of fire- and corrosion-proof spun glass, weighing about 3½ lbs. per cu.ft.

Effects of intense cold on metal, rubber, bearings, lubrication, tolerances, etc., are discussed. Part of the cold room setup consists of two vacuum-tank compression chambers, one of which subjects materials to cold under pressure conditions from sea level to great altitudes and the other will simulate heights to 55,000 ft. *U.S. Air Services*, December 1941, pages 18–20, 1 illus.

Air-Raid Precautions for Aircraft Plants. A brief survey of precautions which can be taken for the protection of aircraft plants against air raid. *Canadian Aviation*, January 1942, pages 35, 36, 56, 1 illus.

"Blackout" Air Conditioning. Leo Hungerford. Many plants in aviation and allied industries are being prepared for blackouts. This article discusses the problem of ventilating closed buildings and gives pointers on plant design and remodeling from this point of view. *Western Flying*, January 1942, pages 44, 46, 4 illus.

War Plant Conversion. John Eley, Jr. A description of the manner in which a plant making fixtures has been converted to an "outside production" plant to serve the expanding needs of the aviation industry. Details of the change-over are explained to show the adaptability to aviation production of completely unrelated facilities and equipment. *Western Flying*, January 1942, pages 48, 50, 2 illus.

More Factory Areas Dedicated to Aircraft Production. A brief descriptive summary of facilities provided in recently constructed plants of Buick Motors at Chicago and Curtiss Wright Airplane Company at Columbus is presented in this account of work area and layout. *Aero Digest*, January 1942, pages 86, 90, 93, 6 illus.

A Huge Plant for Engine Assembly. New expansions at the Pratt and Whitney engine plant are described with an account of the straight line assembly by conveyor system. *Aircraft Production*, December 1941, pages 111–113, 5 illus.

Plastics

Resin-Bonded Friction Materials. D. S. Bruce and R. T. Halstead. A discussion of the use of resin-bonded friction materials in connection with phenolic bonding agents as a means of increasing wear-resistance and life of brake linings, adding to frictional characteristics. *Modern Plastics*, January 1942, pages 40, 41, 94, 96, 98, 4 illus.

Rapid Determination of the Specific Gravity of Plastic Materials. H. F. Palmer and W. E. Jones. A machine for determination of the specific gravity of reclaimed rubber or other plastic materials is described. Determination is made on an unvulcanized sample which is compressed to 112.5 kg. per sq.cm. (1600 lbs. per sq.in.) in which the case of reclaimed rubber and rubber compounds, and the specific gravity is indicated on a dial. Time required for determination is approximately one minute.

Weight and temperature of the sample and the pressure applied to it affect the result, but with proper control specific gravity is reproducible to the third decimal place. This is more accurate than other specific gravity methods for rubber compounds. *Industrial and Engineering Chemistry* (News Edition), December 15, 1941, pages 854–867, 6 illus.

Plasticizers. A compilation of plasticizers manufactured in the United States is presented in tabular form with data pertinent thereto: trade name; type or chemical name; mol. wt.; sp. g./deg. C.; boiling point, deg. C./mm.; melting point, deg. C.; soly. in water, per cent by wt./deg. C.; flash point, deg. C.; vapor pressure, mm./deg. C.; consistency; color, compatibility; and manufacturer. *Industrial and Engineering Chemistry*, January 1942, pages 68–73.

Advances in Plastics during 1941. G. M. Kline. A general review of plastic developments in 1941. All efforts during the year were concentrated on increasing output of established products. Toward the end of

The freedom from mechanical failures in commercial aircraft in recent years is partially due to the use of Chromium-Molybdenum (X4130) steel for many vital structural parts.

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the year, however, considerable attention was devoted to possibilities of certain natural products in extending available supplies of molding powders. Of primary interest in this connection were furfural, lignin, soybean meal and bagasse. Several surveys appeared regarding materials about which little had been previously published, namely, vinyl alcohol, starch, zein, and coffee plastics. Many new developments in synthetic resins were kept in the laboratory because of lack of plants and personnel to undertake their commercial production.

Fabrication of aircraft structure by the rubber-bag molding process was the subject of many papers during 1941. Its successful operation in a number of plants in this country has demonstrated that it is a practical method for producing airplanes using materials and labor which are more readily available than those required for metal aircraft. Use of resin-impregnated compressed wood for mass production of propellers was of special interest in view of reports from England of their continuing successful operation.

The plastic review continues with special articles on surface coatings; molding presses; resin plant equipment; laminates; phenolic resins; urea-formaldehyde resins; thermoplastics, polystyrene; vinylidene chloride polymers; cellulose esters; and cellulose ethers. *Modern Plastics*, January 1942, pages 57–67, 88, 90, 92, 10 illus.

Wood-Plastic Airplane Parts. Curtis L. Bates. An outline of the progress that has been made in the substitution of phenolic-bonded plywood parts for metal in specific tasks in aircraft construction. This article indicates that, while many of these substitutions were made originally to conserve metal, the wood plastic structure has, in many cases, proved itself superior to the original metal application. Floor boards, trim tabs, folding shelves, partitions and even lightplane wing spars are given as examples. *Aviation*, January 1942, pages 82, 83, 182, 5 illus.

Production

Behind the Luftwaffe. Paul H. Wilkinson. An explanation of the simplified production process used in the construction of Germany's Henschel Hs-126 single-engined high-wing multi-purpose observation type airplane. Extensive use of the automatic forming machine and stretch press, as well as unusual systems of jigging and assembly have permitted accelerated production of this type. *American Machinist*, January 8, 1942, pages 26–30, 11 illus.

N.A.A.'s Regular Procedure on Sub-Contracting. An account of the subcontracting system operated by North American Aviation, Inc. *Southern Flight*, December 1941, pages 18, 19, 28, 3 illus; also *Western Flying*, December 1941, pages 52–54, 60, 4 illus.

Surface Finish. This series of articles, the first four of which stressed effect of surface finish on friction and the wearing qualities of parts in contact with each other, compared results obtained from various machining processes, and described equipment for honing aircraft parts, is concluded with a review of the comparatively new superfinishing process developed by Chrysler Corp.

Although photographs show automobile parts, the principle is equally applicable to aircraft. Tabulated data compare results obtained from five different methods of finishing surfaces; present recommended work and abrasive speeds for automobile components, which may be applied to aircraft parts of similar dimensions and material; and superfinishing data obtained under quality production contions. *Aircraft Production*, December 1941, pages 93–100, 17 illus.

Buick Turns Out First Aircraft Power Plant. Notice of the first aircraft power plant turned out by Buick motor division of General Motors Corporation within 243 days from the submission of blue prints. Some indication of the acceleration of Buick's engine production program is given. *Automotive News*, January 19, 1942, page 2.

The Blackburn Botha—II. W. E. Goff. Unique tubular construction embodied in Blackburn Botha wing was discussed in part I of this series. Detailed review of processes employed in the manufacture of the center plane was also included. In the outer wing of the airplane, the same type of construction is used. Production of this component and the fuel tank is described in present installment, together with that of other units of the aircraft. *Aircraft Production*, December 1941, pages 76–85, 18 illus.

America Produces Wings for Victory. A brief summary statement on the status of American aircraft production at the time of the outbreak of war with Japan. *Canadian Aviation*, January 1942, pages 18, 19, 31, 2 illus.

Automotive Participation in Aviation Production. An informative chart setting out the various items fabricated by twelve of the largest automobile manufacturers in the United States for military aircraft. *S.A.E. Journal*, January 1942, page 32.

Canada Manufactures Wings for Freedom. Ralph P. Bell. The Director-General of Canadian aircraft production surveys the Canadian problem and its progress. Setbacks and disappointments are reviewed along with the program's achievements and prospects.

A section of brief articles follows, outlining the production program and facilities at each of various plants in Canada. These include the plants of Canadian Car, Fairchild, Noorduyn, Fleet, Canadian Vickers, Federal, National Steel Car, deHavilland, MacDonald, Boeing Aircraft of Canada and Ottawa Car and Aircraft. *Canadian Aviation*, December 1941, pages 28–31, 34–48, 86–90, 92, 96, 84 illus.

Roller-Line Assembly. An explanation of the roller-line conveying system which acts as the backbone of Aircooled Motors Corporation's assembly line. The system used commences with the erection of the crankshaft on a vertical mount, and is followed with the addition of various parts, until the completely assembled Franklin engine emerges, ready for test at the end of the line. *Aviation*, January 1942, pages 78, 79, 228, 9 illus.

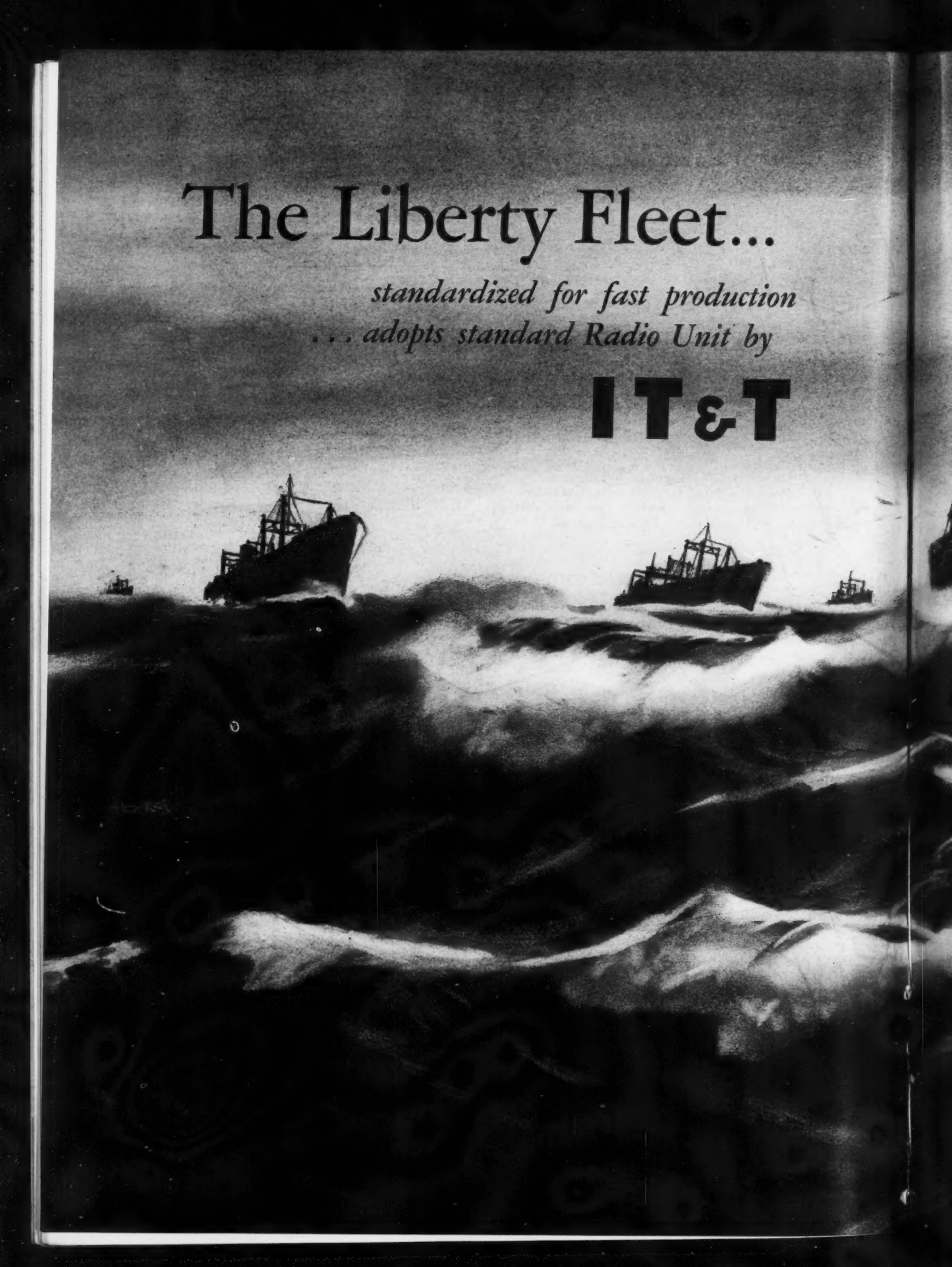
From Print to Part in Eight Hours. James Harris. This account of the development, advantages and use of Kirksite dies for punch press work indicates the applicability of this alloy in saving time and money for the hammer, foundry and press department of Lockheed. A photo series following a Kirksite die from blueprint to the production line in a little over eight hours is included. *Aviation*, January 1942, pages 70, 71, 188, 9 illus.

Building the B-24. Major R. H. Fleet. The president of Consolidated Aircraft outlines the history of the company and describes the production routine in the manufacture of the four-engined B-24 bomber. *Aviation*, January 1942, pages 66–69, 222, 224, 226, and 228, 6 illus.

Propellers

Repairing Wooden Blades. An explanation of the manner in which scarfed joints can be used to make damaged wooden propeller blades serviceable. The strength of glued joints, in this method, is independent of blade material. The system described is used by Air Screw Co., Ltd. *Flight*, December 4, 1941, pages 400a, 400b, 3 illus.

Contra-Props. F. W. Lanchester. A pioneer in co-axial contra-rotating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development reminisces on early considerations of the subject by the Naval Advisory Committee and describes a patent he secured in 1907 for a form of drive described in this article. Suggestions are made as to trends which future contra-prop research should take. *Flight*, December 11, 1941, pages 418, 419.

Rotating Wing Aircraft

Helicopters of Tomorrow. Igor Sikorsky. The writer reveals plans for new rotating wing aircraft predicting wide use for helicopters after the war. The designer states that on the basis of his experiments the true helicopter will probably not exceed 150 miles per hour in speed. *Aviation*, January 1942, page 90, 2 illus.

The New Helicopter. Brief explanation of the performance and the design principle of the VS-300 Helicopter. *Yankee Pilot*, January 1942 pages 15, 18, 2 illus.

Stress Analysis

A Suggestion for Columns of Varying Section. Charles O. Harris. The analysis of a slender column of varying section is usually difficult. This paper suggests that the problem of the varying column be approached from the point of view of determining the variation of section which will give a certain previously designated property.

Three such properties are mentioned. Constant M/EI along the length, under the critical load; constant Mc/EI under the critical load; and minimum use of material. The first two are represented by examples, and come near to achieving the third. The first case is said to be easy to apply. *Journal of the Aeronautical Sciences*, January 1942, pages 97–99.

The Mechanical Impedance of Damped Vibrating Systems. R. G. Manley. The concept of "mechanical impedance," a quantity equivalent to Biot's Dynamic Modulus, has been utilized since 1939 by the de Havilland Aircraft Co. as a standard method of treatment of vibration problems in engine-propeller systems, the method being applied principally to torsional vibrations. In this work, the effect of damping force was neglected on the assumption that the resonant frequencies of a system are not affected appreciably by such forces so long as they remain of small magnitude. The desire to justify this assumption by theoretical reasoning, and to evolve a method of attack for problems in which the damping forces are too large to be neglected, led to application of the concept of mechanical impedance to damped systems.

Three operators using the Micro DD shear, brake and bender for the rapid duplication of nominal quantities of varied metal pieces. These devices permit their accurate shaping without the time or expense of dies or die sets and without applying existing tools and machinery.

The analysis indicates that the effect of small damping forces can be neglected in the calculation of the resonant frequencies of vibrating systems. In practice, this allows the continued use of the impedance curves calculated on the assumption of zero damping. Further, if the damping forces are large, methods described enable the vibration characteristics of the system to be determined with an ease hitherto regarded as unattainable. *Royal Aeronautical Society Journal*, November 1941, pages 342–348, 9 illus.

Tools and Equipment

Vega Applies Cast Dies. James A. Harris. The foreman of the hammer, foundry and press department explains the method by which Vega Airplane lowered tooling costs, accelerated die production and decreased the cost of machine setups by the use of Kirksite punch-press dies for sheet metal parts. The article contains a photographic account of the production of a complete Kirksite die from blueprint to punch-press in eight hours *American Machinist*, January 8, 1942, pages 15–19, 12 illus.

Motor-Driven Capstan Lathe. In the No. 2D Herbert capstan lathe described, any one of eight spindle speeds in either direction can be obtained instantly without stopping the spindle. Drive is by a four-speed pole-changing motor through a gear-box which provides two speeds to a two-step cone pulley in the cabinet leg. The pulley drives a similar one on the spindle, and by moving the belt a second range of eight speeds is obtained.

This arrangement provides sixteen reversible spindle speeds in two ranges of eight according to the position of the belt on the two-step cone. Fast feed is advantageous in working in brass and other soft materials. Slow feed is suitable for forming cuts when extra power is needed. *The Engineer*, November 7, 1941, page 322, 2 illus.

Modern Machine Tools. Latest British additions to the range of factory plant equipment are presented in photographs and descriptions of a Simplex knee-type boring machine, a Kent-Owen production milling machine, a Hazlewood and Dent metal spinning lathe, an automatic elevating diehead holder fitted to a capstan lathe to allow threading of work normally beyond capacity of the machine, and a new series of Niagara power-driven squaring shears. *Aircraft Production*, December 1941, pages 107–110, 6 illus.

Shop Equipment and Small Tools. This monthly presentation of modern aids to efficient production includes Euco knee-tool which provides micrometer micrometer adjustment for tool shank; G.E.C. flameproof inspection torch for use in inflammable atmospheres; Omaro slide-rule which gives sheet-metal bending allowance for different angles and gages; Broomwade B.S.M.-type squeeze riveter; Rotameter for measuring flow of gas through pipeline, and new range of Norton fly-presses. *Aircraft Production*, December 1941, pages 87, 88, 6 illus.

Extrusion Miller Saves Time. An explanation of the use of a high cycle extrusion milling machine to effect time economies in this phase of Lockheed P-38 production. *Canadian Aviation*, December 1941, pages 68, 76, 3 illus.

Fleetwings Steps Up Production. Description of some of the new specialized tools built by Fleetwings to accelerate production. These include bucking yokes which permit one riveter to complete his operation without another worker to buck; hole transfer jigs which permit the lining up of the hole to be drilled in a part directly with a hole in a forging; and a device for bevelling overlapping edges, time-saving rivet punches and similar devices. *Aviation*, January 1942, pages 74, 76, 182, 7 illus.

Honing Tools and Related Equipment. L. S. Martz. Discussing the application of such equipment to production technique, this paper treats of the functions of the honing process; major requirements of surface generation, including surface quality, plastic deformation and stock removal by shear; fundamental principles of abrading actuation, including abrasive structure, force application, direction of motion and rate of motion or speed; and unique controls used in honing equipment, including tool construction and actuating controls. *Mechanical Engineering*, December 1941, pages 865–869, 9 illus.

Training

Post Graduate Pilots. Capt. Wm. P. Nuckols. An account of the advance training programs of the Air Corps with an outline of the work involved in training pursuit and bombardment pilots, bombardiers, aerial navigators and aerial observers. *Western Flying*, December 1941, pages 24–26, 42, 7 illus.

Texans Make "Good Hands." Faced with the problem of securing personnel for a new plant, North American Aviation placed more than 5,000 persons on its payroll in the first year since the plant was opened. Ninety-five per cent of them are Texans. The methods used to combat the problem of staffing the plant without retarding a speedy production problem is here described. *Southern Flight*, December 1941, pages 20, 21, 12 illus.

Ground Staff Training. An account of the system used in training ground crews for the R.A.F. Included in this class of training are flight mechanics, fitter armorers and women in auxiliary units. *The Aeroplane*, December 19, 1941, pages 678, 679, 7 illus.

The Air Crew Pattern for Ground Crews. "Watchkeeper." Lauding the skillful organization and operation of R.A.F. training of pilots, observers and air gunners, this columnist describes shortcomings in organization and operation of ground crew training for the R.A.F. and suggests that it might well be modeled after the highly successful air crew training system. *The Aeroplane*, November 28, 1941, page 591, 2 illus.

Which Course? James Rollins. A survey of the various kinds of work offered now and in the future by the aviation industry. Included are suggestions for the right kind of schooling to prepare one for these particular tasks. *Air Trails*, January 1942, pages 14, 15, 46–48, 51, 8 illus.

Training the Naval Aviator. Capt. A. C. Read. The Commandant of the Naval Air Station at Pensacola, Florida, explains the operation of a naval air training station, presents the qualifications necessary for a naval aviation candidate and outlines briefly the course of study and the general living conditions in the particular station. The location of recruiting offices, the salary, living conditions and general education requirements of the naval aviation service are also given. *Flying and Popular Aviation*, January 1942, pages 80–83, 17 illus.

Aircraft Production Training Course. No. 5. The fifth in a series of instructional articles gives pointers on learning to read blue prints. *Canadian Aviation*, December 1941, pages 58–60, 9 illus.; January 1942, pages 42, 44, 46, 56, 14 illus.

Technical Training. An account of the technical training being given to thousands of Royal Air Force ground staff. The training of Polish ground staff operates automonously. *Flight*, December 11, 1941, pages 423, 426, 11 illus.

Warfare

War in the Air. An interpretive news report on military air activities in the Far East beginning with Japan's attack of December 7 and carried forward through the first tense days up to the outbreak of war. American, British and Japanese air operations with attendant land movements are reviewed. *Western Flying*, January 1942, pages 31, 32, 60, 4 illus.

Prelude to War. A review chiefly in photographs of the air exercises held in the Carolinas just before the outbreak of the present war. *Aviation*, January 1942, pages 138, 139, 7 illus.

America at War. The first in a series of articles on the state and progress of the war, this installment lays out the field of action in the Pacific, indicates the distance between attack centers and objectives, sums up the advantages of both sides and outlines the immediate steps the United States has taken to strengthen resources. *Aviation*, January 1942, pages 52, 53, 190, 3 illus.

The Bombers of the Fighter Command. The Hawker Hurricane of Fighter Command has been adapted to bombing. Results of the Hurricane attack on railway targets and factories (bombs with delayed-action fuses were used, dropped from low levels) showed that the adaptation of the Hurricane to bombing in no way impaired its qualities as a fighter. Early in November, escorted by two wings of Spitfires, the Hurricanes flew to St. Pol, wrecking a Nazi factory. This operation formed part of biggest daylight offensive ever launched over Northern France. At times there were more than 300 fighters in the air. *Aeroplane*, November 14, 1941, pages 531, 532, 4 illus.

Welding

Welding in Construction and Maintenance of Aircraft. A. K. Seemann. A general article on aircraft welding, treating of design, selection and inspection of materials, establishment of welding procedure, qualifications of the welding operator to follow the procedure and inspection and testing of completed work. *Aero Digest*, January 1942, pages 187, 188, 191, 192, 195, 13 illus.

Note sulla Saldabilita: Sua Definizione e Determinazione (Note on Weldability: Its Definition and Determination). G. Carro Cao. Consideration of the characteristics required of a technically perfect weld, and description of some definitions and research methods proposed by some investigators as compared with several proposals of the author. *L'Aerotecnica*, September-October 1941, pages 592–614.

Spot Welding Light Alloys. H. St. G. Gardner. Principles underlying design of condenser discharge type of machine and results obtained in practice are discussed in detail. *Aircraft Production*, December 1941, pages 89–91, 5 illus.

Arc Welding for Aircraft. A description of Vultee Aircraft's use of electric arc welding for tubular fuselage structures. *Canadian Aviation*, December 1941, pages 62, 1 illus.

Welding. A. K. Seemann. A survey of most recent developments in welding technique as pertains to aircraft production. Procedure control for welding jobs is described along with the essentials of designing for welding, the various reasons for cracks in welds, the selection of materials and welding technique in general. *Canadian Aviation*, December 1941, pages 55–57, 78, 80, 11 illus.

Crack Sensitivity in Welded Chromium-Molybdenum (1% Chromium, 0.2% Molybdenum) Steels of Tnin Section. J. G. Ball. According to

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this article, the phenomenon of cracking in welds on chrome-molybdenum steel of thin section has been limited to material of German manufacture, although its composition and apparent physical characteristics were the same as English or American melts. This article offers several of the popular explanations of this fault in products by various German metallurgists. *Institute of Welding Transactions*, October 1941, pages 181–187.

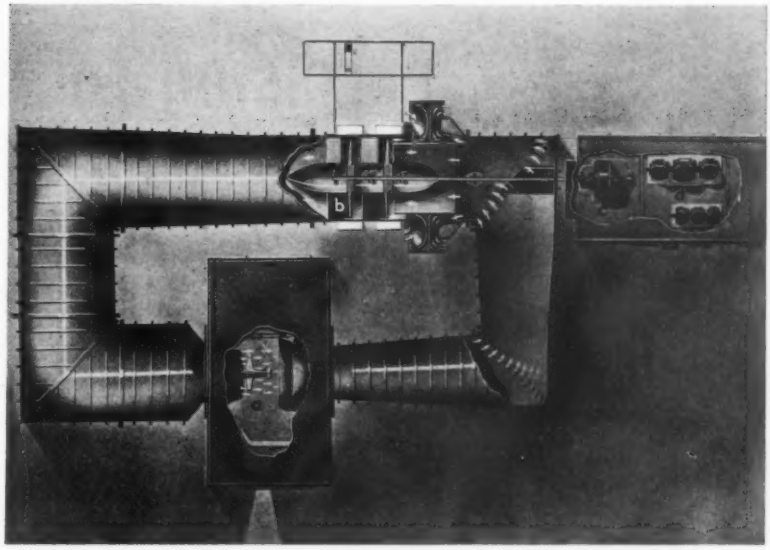
The Function of Contact Resistance in Spot Welding. R. F. Tylecote. A study of the nature of contact resistance, the additional resistance noted in electrical welding greater than the metallic resistance of the separate pieces to which the current is applied. The article surveys the physical problems involved in spot welding, the effect of pressure, temperature and surface conditions and the change of resistance during the welding cycle. *Institute of Welding Transactions*, July 1941, pages 154–165, 19 illus.

Wind Tunnels

Wind Tunnel at Chalais-Meudon. Constructional and operating details of the wind tunnel built for the French Air Ministry at Chalais-Meudon, Seine-et-Oise, which came into possession of Germany with the fall of France. Of the Eiffel open-jet type, tunnel has an over-all length of 313 ft., and consists essentially of five main structures.

Longitudinal section and ground plan of the tunnel are sketched and principal dimensions given. Maximum speed of airflow around a model was claimed by the French to be 112 m.p.h. and by the Germans 100 m.p.h. Description of the tunnel, which, upon taking over the Germans found partially dismantled, covers: test house, diffuser, structural features, control system, six-component balance, continuous records, pitching moments, measuring turning moments, testing propellers, cooler tests, range of tests, and characteristics of air stream. Diagram shows principle of the six-component balance.

Photographs include air-view of complete tunnel, mouth of collector, general view of test house interior, pivoted shutters at mouth of diffuser, interior of diffuser, showing six exhauster fans, external view of diffuser (elliptical tube of reinforced concrete, weighing 570 tons and spanning 111 ft. between supporting walls), fan shrouding and platforms for 1,000-hp. electric motors, and quarter-scale model of "Hy 20" floatplane set up for test. *Aircraft Production*, December 1941, pages 68–72, 10 illus.



Schematic top view drawing of the Wright Field wind tunnel.

Miscellaneous

Airplanes vs. Forest Fires. S. R. Winters. The use of airplanes for fighting forest fires is discussed in this report on tests conducted by the U.S. Forest Service during the past 5 years to determine the possibilities of bombing forest fires out of existence. *Western Flying*, December 1941, pages 32, 33, 2 illus.

Activity at Assembly Units. G. Geoffrey Smith. An account of the manner in which United States built aircraft are being handled in Britain with some details on modifications being made on the latest American types to meet the specific needs of British air operations. A few details on the new types being received are also given. *Flight*, December 18, 1941, pages 442f–h, 7 illus.

Der "Zwerg-Diesel" als Flugmodellmotor (A Tiny Diesel as an Engine for Model Airplanes). A description of a very small Diesel engine for model airplanes. Only the compression-ignition system of the Diesel is applied; otherwise it has a carburetor. The operation of the engine is described. The compression chamber is so small that the compression ratio is about 20 : 1, or even higher. If the proper fuel is used this engine will pick up at once and will run for quite some time. However when it has run for a certain length of time it becomes overheated, causing advanced ignition and thus back-firing.

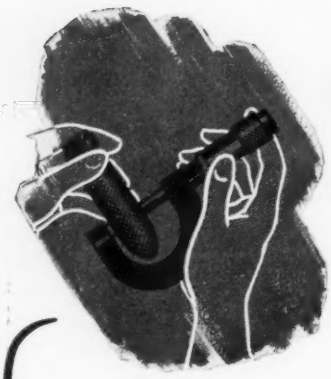
To prevent this, the compression ratio is made variable. For this purpose the part which forms the cylinder base is constructed as a piston, and may be axially displaced in the cylinder by means of a thumb screw. To start the engine, adjustment is made for a high compression ratio to get proper ignition.

As soon as the engine is warm enough the compression ratio is decreased to the point where the engine output is best. If the load remains uniform no further adjustment is necessary. The weight of this miniature engine complete with propeller is about 13 ounces. *Schweizer Aero-Revue*, October 1941, pages 27–29.

Atlantic Ferry. An account of the cooperation between U.S. Army Air Corps and R.A.F. Ferry Commands in delivering bombers from American factories to Britain. The frequent changes in specification are noted as a more frequent cause than delay in parts manufacture for airplanes leaving the assembly line short of some equipment. The manner in which such equipment is added at stopping points en route during delivery is pointed out. *Flight*, December 4, 1941, pages 400e–400g, 6 illus.

America's Latest. Brief descriptions of the flying qualities and maintenance of American military airplanes most recently placed in British service. Some details are given on the ferrying of these airplanes and on the assembly of those shipped. *The Aeroplane*, December 12, 1941, pages 658, 659, 5 illus.

The "Galcit." Clark B. Millikan and E. W. Robischon. The important work being done by the Guggenheim Aeronautical Laboratory, California Institute of Technology, both in the training of aeronautical engineers and in the advancement of aeronautical research is outlined in this description of the school's aeronautical activities and departments. *Aero Digest*, January 1942, pages 146, 150, 312, 313, 4 illus.



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1. Fuel Tank Inlet Strainer made from 5 mesh, .023" diameter wire Monel wire cloth, with brass reinforcements.

2. Fuel Line Strainer made from 60x50 mesh, .008" diameter Monel wire cloth, with brass ring and flange and phosphor bronze reinforcement strips.

3. Fuel Line Strainer made from 60x50 mesh, .008" diameter wire Monel wire cloth, with brass flange and collar reinforcement.

4. to 7. Finger Strainers for Gas Tank Outlet. Made from 18 mesh, .018" diameter wire Monel wire cloth, with brass ferrules and collars.

Government Publications

U. S. Army Air Forces

Conduct of Field Artillery Fire Using Air Conservation. This manual covers the methods and procedures for control of field artillery fire using air observation. The booklet describes the type of aircraft necessary for this work and outlines its assignment and the type of missions upon which it can be used. The general procedure for registration, surveillance, adjustment and communication are given in detail. Considerable information is also given on the ground-to-plane radio procedure and the complete fire control code is appended. *War Department Technical Manual No. 6-210*, Superintendent of Documents, Washington, D. C., 36 pages, $0.10.

Elementary Map and Aerial Photograph Reading. This manual presents in simplified form the information necessary for the instruction of all military personnel on the elements of map reading and the interpretation of aerial photographs. It covers the conventional signs and military symbols; explains distances, scales, directions and azimuths, coordinates, relief, slopes, profiles and visibility, map reading in the field and aerial photograph reading to an extent sufficient to permit soldiers and platoon leaders to read aerial photographs and aerial mosaics. *War Department Basic Field Manual FM 21-25*, Superintendent of Documents, Washington, D. C., 100 pages, 63 illus., $0.30.

Heat Treating and Inspection of Metals. This manual discusses the heat treatment of various types of alloys and metals used in the construction and maintenance of military aircraft. It describes first the equipment used and the general treatment of steels of various types, aluminum and other alloys. Hardness testing and magnaflux inspection are also explained. *War Department Technical Manual TM 1-423*, Superintendent of Documents, Washington, D. C., 57 pages, 14 illus., $0.10.

Physiological Aspects of Flying and Maintenance of Physical Fitness. This manual is presented to instruct all flying personnel in those physiological aspects of flight which are detrimental to the normal functioning of the human body. The object of the study is to make possible preventive or corrective measures to maintain the high standard of physical fitness required for proper performance of aircraft.

The manual describes the earth's atmosphere and discusses in sequence the effect upon the human body induced by altitude, cold, acceleration and centrifugal force. Psychological aspects of flying are considered along with psychiatry in so far as it pertains to flying personnel.

The work is concluded with a discussion of the necessity for the high standard of physical fitness and the selection of flying personnel; also emphasized is the need for individual effort by the pilot in maintaining this state of physical fitness. *War Department Technical Manual TM 1-705*, Superintendent of Documents, Washington, D. C., 127 pages, 34 illus., $0.25.

Milling Machines, Shapers, and Planers. This manual describes the various types of milling, shaping and planing machines used in aircraft construction and maintenance by the Army Air Forces. It describes their operation and maintenance and gives a detailed explanation of the holding and indexing of work, the calculation of gears, the speeds, feeds and cutting tools used in the planers and shapers. *War Department Technical Manual TM 1-421*, Superintendent of Documents, Washington, D. C., 192 pages, 144 illus., $0.25.

Radiotelephone Procedure, Air Corps. This pamphlet compiled under the direction of the Chief of the Air Corps presents a simplified explanation of the general procedure in the use of the radiotelephone between aircraft and the ground stages, and also between units of aircraft and flight. It contains a general introduction in the use of the radio equipment giving directions for enunciation, speech rate, continuity, corrections, compliance and the like.

Separate directions for weather and the use of the radiotelephone in conjunction with weather reporting and winds-aloft reports are offered as well as directions for control tower calls and the general use of radio ranges in frequencies. The appendix contains the charts and symbols, phraseology and abbreviations, and the phonetic alphabet in general radiotelephone use. *War Department Technical Manual No. 1-460*, Superintendent of Documents, Washington, D. C., 67 pages, $0.10.

Basic Photography. This manual serves as a reference to basic principles and technique of military photography. It includes the elementary physics of photography, the chemistry of sensitized materials, optics, filters, photographic sensitivity, ground camera photography, and other basic photographic principles involved in the military use of the camera. Other technical manuals dealing with aerial photography are frequently referred to in this publication. *War Department Technical Manual TM 1-219*, Superintendent of Documents, Washington, D. C., 242 pages, 77 illus., $0.35.

Theory of Flight. This general manual contains the fundamentals of aerodynamics presented in such a manner as to provide the new Air Corps personnel with the necessary technical training to understand and observe the orders and instructions covering the use and operation of military aircraft. It offers a simplified explanation of the mechanical and physical laws which govern airplane performance and a well-rounded picture of the limitations of the airplane as well as its best use.

The work opens with a basic explanation of the history and mathematics of the airplane as well as its general structures and an introduction to aeronautical nomenclature. The general fundamentals of aerodynamics, the study of air foils, lift and dragging propellers, performance, stability, control and dynamic loads are explained as well as the ultimate use of aircraft as a military factor. The main appendix contains a contracted version of the N.A.C.A. nomenclature. *War Department Technical Manual No. 1-400*, Superintendent of Documents, Washington, D. C., 182 pages, 118 illus., $0.30.

U. S. Navy

Aircraft Navigation Manual. In view of the increased program of aviation training under way at present, it was considered advisable to revise the first manual of air navigation issued by the Hydrographic Office in order to eliminate much of the material restricted to the Naval Office and to make the manual available to the public. Using as a basis the course in navigation at the Naval air station at Pensacola, Florida, material on elementary air navigation is compiled by the officer instructors of the Pensacola school in cooperation with the Hydrographic office.

Wherever practical, an adequate number of problems and answers are presented so that the publication may be available to both student pilots and service aviators. The book contains the basic navigational definitions with general directions as to the types and interpretations of charts and publications.

Aircraft navigation instruments as well as the general methods for dead reckoning, radio and celestial navigation are set forth. The Airways Systems and Meteorological Services of the United States are described and their application to safe navigation is explained. The book closes with a nomenclature of navigational terms. *Hydrographic Office* No. 216, Superintendent of Documents, 258 pages, 113 illus., $1.00.

National Advisory Committee for Aeronautics

The Design of Propeller Blade Roots. G. Cordes. The translation of an article, "Bemessung von Luftschraubenflügelfüssen," published in *Luftfahrtforschung*, April 22, 1941. Predicted on the assumption of certain normal conditions for engine and propeller, simple expressions for the static and dynamic stresses of propeller blade roots are evolved. They, in combination with the fatigue strength diagram of the employed material, afford for each engine power one certain operating point by which the state of stress serving as a basis for the design of the root is defined. Different stress cases must be analyzed, depending upon the vibration tendency of engine and use of propeller. The solution affords an insight into the possible introduction of different size classes of propeller. *N.A.C.A. Technical Memorandum No. 1001*, 14 pages, 14 illus.

The Temperature of Unheated Bodies in a High-Speed Gas Stream. E. Eckert and W. Weise. The translation of an article, "Die Temperatur unbeheizter Körper in einem Gasstrom hoher Geschwindigkeit," published in *Forschung auf dem Gebiete des Ingenieurwesens*, January-February 1941. This report deals with temperature measurement on cylinders of 0.2 to 3 millimeters diameter in longitudinal and transverse air flow at speeds of 100 to 300 meters per second.

Within the explored test of range, that is, the probable laminar-boundary layer region, the temperature of cylinders in axial flow is practically independent of the speed and is in good agreement with Pohlhausen's theoretical values. On the other hand, in transverse flow, cylinders of certain diameter manifest a close relationship with speed while the ratio of the temperature above the air of the body to the adiabatic stagnation temperature first decreases with rising speed and then rises again from a Mach number of 0.6. The importance of this "specific temperature" of the body for heat transfer studies at high speed is discussed. *N.A.C.A. Technical Memorandum No. 1000*, December 1941, 15 pages, 7 illus.

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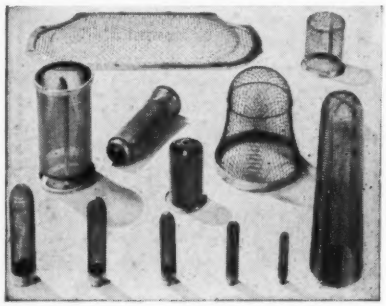

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U.S. Office of Civilian Defense

Report of Bomb Tests on Materials and Structures. A memorandum on protective construction prepared under the direction of the Chief of Engineers, United States Army. It contains first a description of the results of a test made to determine the relative resistance to splinters and blast effect of bombs on common wall panels and special panels designed to resist bombing. Eleven panels 5 ft. high and 10 ft. wide were mounted on vertical wood frames and buttressed with sandbags.

These panels were of common building material such as wood, brick veneer, brick, corrugated iron, structural steel, sandbags, plywood and other similar materials. They were placed on the circumference of a circle drawn with a 50 foot radius around a 600 pound demolition bomb. The bomb was statically detonated. The test was then repeated with a foot circle from a 300 pound bomb and the results compared.

Acting on these results and those taken from studies abroad, various designs of splinter proof aircraft shelters were presented and later tests on these shelters with various types of bombs released from aircraft were conducted indicating their effectiveness in repairing various types of air attack. *U.S. Office of Civilian Defense*, Washington, D. C., 55 pages, 52 illus.

Civil Air Patrol. An explanation of the organization, purpose, program and enlistment requirements of the Civil Air Patrol, which was established by the United States Director of Civilian Air Defense on December 1, 1941. The booklet outlines the necessity for such an organization, presents a chart of its general structure, outlines its purpose and qualifications required for participation, and contains as part of it an application form for membership. *U.S. Office of Civilian Defense*, Washington, D. C., 18 pages.

Civil Aeronautics Administration

Inspection Handbook. A revised copy of Chapter XIX, "Aircraft Engines," of the Civil Aeronautics Administration inspection handbook together with numerical lists of current aircraft engines, propeller appliances, product and process specifications was issued recently by the Civil Aeronautics Administration. Specifications for inactive engines are listed alphabetically by manufacturer and models in this edition, superceding a previous one issued in July 1936. The new chapter and separate engine specifications list comprise a complete file of such specifications as of December 1941. *Air Safety Release No. 81*, December 1, 1941, 45 pages.

Air Speed Indicating Systems. The aircraft engineering division of the Civil Aeronautics Administration has prepared a special bulletin on the functioning of the air speed indicator which, according to the introduction, was not intended as directions for repairs but for educational purposes.

The bulletin contains a simplified technical description of the air speed indicator and contains trouble shooting hints for the various malfunctions which, under operating conditions, frequently affect the accuracy of the instrument. It offers general suggestions relating to causes and remedies. General service directions for the proper maintenance of the instrument are also included. *Safety Regulation Release No. 86*, December 31, 1941, 8 pages.

Icing Conditions Create Hazard at Lower Levels. A short survey on ice accretion within the convective layer made in the light of a recent technical note written by J. A. Browne, meteorologist in charge of the Transcontinental and Western Air, Inc., New York office. The report indicates that under certain conditions severe ice may be suspected in lower cloud layers under such conditions as the passage of a secondary cold front near the center of an occluded low with freezing temperatures at the colder side, and in conditions of moderate wind with little spread between temperature and dew point.

The article also offers some general rules for determining the time when intensity of icing conditions would decrease. It indicates that when precipitation changes to dry snow, when the surface temperature falls to 5° below freezing, or when the temperature dew point spread becomes 5° or more general icing conditions probably are not to be expected. *Civil Aeronautics Journal*, January 15, 1942, page 28.

U. S. Weather Bureau

Instruction for Airways Meteorological Service. A fifth edition of the general circular covering instructions for the airways meteorological service was issued recently to supersede all previous copies of the circular as of November 1, 1941. It contains a general description of the function and organization of this branch of the Weather bureau and its administration and supervision.

A large part of the circular is devoted to instructions for making, recording and transmitting weather observation, giving lists of transmissional symbols and similar specific instructions. The general procedure of weather forecasting and analysis is explained in simplified form, as well as the function of the instruments from which the observations are taken.

Most of the commonly used meteorological tables, sunrise and sunset data, heights of clouds, etc., are also listed. *U.S. Weather Bureau, Circular N*, Superintendent of Documents, Washington, D. C., 201 pages, 28 illus., $0.65.

Preliminary Studies in Seasonal Weather Forecasting. Richard Hanson Weightman. A survey of the problem of long-range weather forecasting is presented in this study which reports previous investigations in this field and describes the objectives, scope and results of the present study. The data on which it is based are included in the report.

The purpose of the present investigation was to make a preliminary survey of associations between pressures at foreign stations and subsequent temperature and precipitation in the United States, by means of simple correlation coefficients. The data obtained during the ten years since this study was first begun point out the areas outside the United States in which antecedent pressure conditions might be suggestive of time-lag relations with conditions in the United States. *Monthly Weather Review*, Supplement No. 45, Superintendent of Documents, Washington, D. C., 99 pages, $0.30.

Securities and Exchange Commission

Aircraft and Aircraft Equipment. Comparative financial data on 35 companies registered with the S.E.C. and engaged in the manufacture of aircraft, engines equipment and accessories. The report, compiled by a W.P.A. project under the direction of the S.E.C., covers the fiscal periods 1939 and 1940. The survey contains combined and individual balance sheets and profit and loss statements for 31 aircraft companies as well as other data on their financial condition during that period.

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This service library for aeronautical research is available to the qualified public for reading privileges. Source material includes aerodynamic and structural research reports as well as books on drafting, production methods, history and allied sciences.

The Institute, through this newly established library, is furnishing books, periodicals and pamphlet material which will be circulated to the participating aircraft companies, to supplement their engineering libraries.

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American Air Transport

The winner of the first Alfred A. Knopf Fellowship Award for an important historical contribution is a book on the history of air transportation in the United States. It represents a constructive report on the evolution of air transportation from an infancy flaming with adventure, triumph and tragedy to a full-blown industry that is here to stay—the greatest step forward in the history of transportation. The enactment of this development is set forth in this broad picture of the men and events, the successes and failures that blazed its trail.

As the author writes in his introduction, "Almost any airline veteran who reads this book will say that he would have written it differently, but since no two of them agree on all the facts, the neutral observer can only use his own best judgment in setting down such a chronicle as honestly as he knows how." This qualification is equally applicable to the treatment given his subject.

As a broad historical study, and as an exciting narrative of business history, *Airways* is a masterly piece of work. But, as a thorough, comprehensive source book on this most important development in aviation, the book falls short of its mark. To record matters of historical moment on the eve of their happening is a difficult job at best; however, it is only in the light of reflection of time that such matters can be reported with true accuracy and in a form useful to the student and investigator. Apparently, the objective of the study, beyond providing an interesting story, is to afford both the casual reader and the student of modern business history a foundational approach to a story the real telling of which must await the aftermath of the present World War.

Introducing his story with an account of commercial aviation's adolescence, the writer interprets the period during which, "after 1915, the World War began to shape the destiny of American flying." While the account goes back of the last decade to fathom the basis of air transportation's amazing progress in 1930–40, it furnishes full treatment of the period of growth which made American airlines the synonym for speed, safety and reliability, and the period during which it met with and rebounded from a Senatorial investigation and subsequent legislation. It describes how the industry developed modern skyliners; the establishment of a separate government authority to control civil aviation; and the politics and factors of the second World War which revived the same old problems.

An appendix contains considerable matter on airline statistics, regulation and chronology. Bibliographical notes are extensive, though short of many useful and standard references. The index reflects a want of treatment on certain aspects of serious importance to the subject, such as air cargo.

To the avid, sagacious student of events, the future of civil aviation, particularly air transport as a business, can but be clear with a reading of *Airways*, despite the fact that interpretive prognostication is notably wanting. To old-timers in aeronautics, the book will prove superficial in the lack of data on the "sweat and blood" elements of aviation which resulted in failure and bitter disappointment but made distinct contributions to air transportation as we know it today. Yet history, be it of business, politics or society rests largely on the record of successes or accomplishments, and the want of background information can hardly be decried in so brief an account of America's newest major development in transportation.

Airways, by Henry Ladd Smith; Alfred A. Knopf, New York, 1942; 430 pages, $3.50.

Modern Air War Explained

The aerial phases of modern warfare have become almost unfathomable to the average citizen. The high altitude bomber is so remote that all he can feel is awe and perhaps a mild terror when even a harmless transport drones in the sky.

Capt. Burr Leyson, veteran simplifier of aviation, presents in this book a systematic breakdown of the components of modern aerial warfare, from its historic and physical sources and tracing its progress to the current conflict and its effect on the average man.

The various phases of aerial warfare are discussed in the order of their relative importance to the layman, beginning with the fighter airplane. Its inception in the unsteady days of the first World War and the beginnings of fire power and fighting technique are reviewed. There follows a remarkably complete picture of present equipment and conditions. Similar treatment is given bombers of various types and Naval aircraft including lighter-than-air.

The actual technique of modern warfare, particularly bombing and the strategic use of parachute troops and glider-infantry are presented along with other modern innovations and simplified explanations of their use during recent months of the European war.

Frequently confused facts about the complex modern airplane, its engine and propeller are clarified with a view to explaining why air power cannot step from the "on-order" stage into combat. This includes a clear presentation of both sides of the air-cooled vs. liquid-cooled engine argument, as well as an exposition of the arming, armoring, supercharging and propelling problems. A survey of such problems as present-day design, manufacture, personnel training and research is made in terms understandable to the layman.

The book gets closest to its general audience in its discussion of anti-aircraft and civilian air defense. Besides tracing the evolution of "Archie" from an airman's joke to a real component of civil defense through increased and more accurate fire-power, the writer describes civil-military warning grids and a highly activated interceptor system. The final chapter on civil air defense is a simplified digest of the flood of foreign literature which has thus far tended to confuse more than inform the general public. It explains the deadliness of air war on civilians, the actual effects of various types of projectiles, and offers a comprehensive set of precautions for civilians under fire. The book closes with a discussion of the position of the American civilian relative to possible air raids.

Wings for Defense, by Captain Burr Leyson; E. P. Dutton and Company, New York, 1942; 210 pages, $2.50.

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Engine Mechanic's Handbook

A modernized reference book on aircraft power plants and allied subjects, this manual is written from the viewpoint of the skilled mechanic who needs handy reference and the aircraft mechanic helper who requires a textbook aid.

The subject of the aircraft power plant is approached from the general standpoint of power plant requirements and design, designating the nomenclature and the parts, and their general use in the aircraft engine. There follows a study of the elements of power plant output, how the weight-horsepower ratios are calculated, and explanations of such terms as piston displacement, compression ratio, volumetrical efficiency and others used in discussing engine power output.

From this point on, the discussion of power plants is divided into basic components which are studied individually from the standpoint of their structure, maintenance and relation to the entire engine. Valves, fuels and fuel systems, lubricants and lubricating systems, carburetors, fuel injection and superchargers, the electrical and starting systems, the ignition and the propellers are among these components so treated. The entirety of this information is then assembled into a general chapter on the operation of the power plant and instructions for servicing and trouble-shooting.

Closing chapters are devoted to the routines of power plant maintenance, details on overhaul and general engine specifications for aircraft power plants. Commonly used mathematical and conversion tables for such calculations as engine, nautical and metric measurements, spheres and solids, weights and substances, fahrenheit and centigrade temperatures and specific gravity are included in the appendix.

Aircraft Power Plant Manual, by G. Burnell Manly; Frederick J. Drake and Company, Chicago, 1942; 759 pages, $4.00.

American Spotter's Guide

Although booklets for identification of friendly and enemy aircraft are quite common abroad, their appearance in the United States is somewhat of a novelty. While this particular booklet bears certain resemblance to British spotters' manuals, its approach takes into consideration the American point of view, and stresses American terminology.

The subject is introduced with general rules for identifying aircraft by their characteristics, such as the number of wings and engines and the contour of wings, arrangement of tail, etc. Following these general definitions, the aircraft in common use by the United States Army and Navy, the R.A.F., the German *Luftwaffe*, the Russian Air Forces, and the Italian and Japanese Air Forces are presented. These include such very recent types as the Avro Manchester, the Short Sterling, the Handley Page Halifax and the Russian 1-17 fighter. More Japanese types are included than even some of the European spotters' manuals contain.

Wherever available, three-view drawings and photographs are given along with special characteristics which would aid in identifying the types. None of the completely obsolete aircraft unlikely to be used further in modern warfare is shown. The entire book is prepared for an intelligent American audience without previous aeronautical knowledge.

Aircraft Spotter, by Lester Ott; Harcourt, Brace and Company, New York, 1941; 64 pages, $1.00.

Kapok Survey

A survey of the history, cultivation and use of Kapok with special consideration for its applications to thermal and acoustical insulation. This book is a by-product of a special study of methods for reducing noise in airplane cabins. Among the materials most successfully applied was Kapok, or tree cotton, long known and valued in the East and used for several decades in the West for mattresses and life preservers. The increased importance of light, sound and thermal insulating material has elevated the significance of this product.

The botanical classification and characteristics of the tree which produces Kapok and the conditions of its cultivation, handling and harvesting are described. Considerable study is given the appearance and the physical and chemical characteristics of the floss derived from Kapok pods.

The earlier commercial uses of the material such as mattress stuffing, fillings for life preservers, clothing insulating and the like are examined along with some of the early attempts to spin this floss into fibers for fabric. Some of the newer uses of Kapok, such as for dirigible flotation gear, are described and the introduction of Kapok-filled materials used as sound and heat insulation is explained. Particular attention is given the acoustical characteristics of this material, particularly in aircraft sound insulation.

Kapok, by Steven J. Zand; obtainable through Trade Commission of The Netherlands Indies, New York, 1941; 119 pages, $1.50.

Thermodynamics

Another in the cadet system series of aviation textbooks, this study of thermodynamics simplifies a subject which usually requires an extensive mathematical and engineering background, to the degree than an understanding of its principles requires only addition, subtraction, multiplication and division.

Following the usual style of this series, that of questions and answers, the book presents the basic principles of heat and heat transfer and the remaining primary physics and chemistry required for the understanding of this particular study. This is followed by an examination of the principles of general engine operation and the workings of the two and four-stroke cycle engine.

Further details are given on isothermal compression and the expansion of gases, adiabatic compression, and the chemistry of aircraft fuels and fuel combustion as well as the heating value of fuels and the measurement of the heat of combustion. Other phases taken up in the book are specific heat, power calculation, engine efficiency, calculation of engine performance and the method of obtaining performance data.

This book is unusual in that it has reduced the subject to the level of the average intelligent aircraft worker now being taken into the industry. While a complete and thorough understanding of thermodynamics would require more instruction than this quiz book offers, the reader is provided with a working knowledge of the subject.

Practical Thermodynamics for Aircraft Engines, by Lieut. Leslie Thorpe; Aviation Press, San Francisco, California, 1941; 240 pages, $3.50.

Bombing

The weapons editor of the New York newspaper, PM, offers a popular presentation of the problems and equipment of air attack, and the defenses available to combat them or minimize their effect.

The author points out first, that fear of the modern weapons and ignorance of their nature can destroy as much life in modern warfare as the missiles themselves. To this end, all aerial bombs are divided into three classes following the basic destructive forces of all military attack—physical violence, fire and poison.

Detonation types, fragmentation and demolition bombs make up the first group. The history of gunpowder from the time of the Chinese, Arabs and Roger Bacon is presented, indicating that the explosive missile is older than most people think. In simple language and with the aid of numerous sectional pictures, the nature, construction and destructive ability of the common types of air-borne bombs are described.

The nature and application of incendiaries of various types are presented in much the same manner, the difference being that this type of missile gives the average citizen under attack the opportunity to do something about it. Methods for controlling burning incendiaries are given in extremely simple terms.

Poison gases, because of their subtle, insidious nature seem to spread more terror in modern war than the physical violence type of weapon, despite the latter's proved effectiveness. While the book does not make any attempt to minimize the seriousness of gas attack, it tells enough about the nature and disadvantages of gas as a wide-area weapon to make some of the readers rest a little easier.

The book closes with answers to such common questions as, how safe are subways and skyscrapers, and which are safer—deep or shallow shelters? The basic virtue of this work is that it is written from a popular viewpoint, still retaining sufficient honesty to neither unduly frighten intelligent people nor lull them into a feeling of false security.

Bombs and Bombing, by Willy Ley; Modern Age Books, Inc., New York, 1941; 124 pages, $1.25.

Modeler's How Book

The associate editor of *Air Trails* presents in this book a compendium of the latest information on materials, procedure and design of model aircraft. The presentation opens with a discussion of the general types of airplane models, both rubber and gas powered, which have been popular since the time of Pineaud.

The tools and materials, and the procedure in making working plans for models are reviewed. Directions and hints are given on construction methods, model engineering and the specific problems involved in the construction and operation of the various types of indoor and outdoor models.

While this book presumes no previous model experience on the part of the reader, its treatment, particularly of gasoline engines, radio control and control-line flying, indicates a respect for the intelligence of the model builder which comes from extended contact with this group. The illustrations are clear, and great care has evidently been exercised to avoid complicated technical drawings.

The Model Aircraft Handbook, by William Winter; Thomas Y. Crowell Company, New York, 1941; 292 pages, $2.00.

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Picture Biographies

A collection of sketched biographies of fifty famous aviators originally executed for the *Newark Evening News* by its aviation editor have been brought together in this booklet. It contains likenesses and interesting sidelights on the personalities of such people as Joe Crosson, Igor Sikorsky, Bernt Balchen, Louise Thaden, Clarence Chamberlin, Vance Breeze, Comm. Charles E. Rosendahl, Roscoe Turner and many others. The introduction was written by Devon Francis, Associated Press aviation editor and president of the Aviation Writers' Association.

Fifty Famous Flyers, by Richard W. Kirschbaum; Charles Dewar Co., Newark, New Jersey, 1941; 56 pages, $0.15.

Payment for Air Mail

An analysis of the issues and problems encountered in determining the amount of remuneration going to the airlines for carrying mails. It traces the relation of these payments to the development of this special class of postal service and the promotion of commercial air transportation from the first air mail service in 1918 to the present time.

All decisions of the Civil Aeronautics Board dealing with the adjustment of air mail compensation from its inception to 1940 are examined along with all decisions of the Interstate Commerce Commission dealing with air carriers from 1935 to 1939. Distinctive characteristics of air mail transportation which render the fixing of airmail pay different from other types of rate-making are discussed. Among them are the ever-present "subsidy" controversy and the perennial problems entering into the determination of air mail costs.

Also discussed are accounting practices, depreciation, the rate base, rate of return and rate scales. Analytical and evaluating treatment is given the discussion of various administrative procedures used by different agencies from time to time to determine the adjustment of air mail compensation.

Air Mail Payment and the Government, by F. A. Spencer; The Brookings Institution, Washington, D. C., 1941; 402 pages, $3.00.

Hydraulic Systems

The function, installation and maintenance of various important makes of British hydraulic equipment, some of which are similar to American installations, are presented in this book. The Lockheed hydraulic system, manufactured by Automotive Products Company, Ltd., of England, is being used to motivate retractable landing gears, flaps, tail wheel and other equipment. Thorough descriptions of the mechanics and installation of such systems are furnished along with directions for maintenance, overhaul and troubleshooting.

The hydraulic equipment built by Dowty is also described. Similar equipment is built under the same name in the United States. Details are given on examples of complete hydraulic installations in the North American 16-3 and the Airspeed types. A close examination is made of various British types of hydraulic pumps. The book is concluded with a general summary on various motivation systems for retractable landing gear.

Hydraulic Equipment, by E. Molloy and E. W. Knott; Chemical Publishing Company, Brooklyn, New York, 1941; 132 pages, $2.50.

British Instrument Manual

A collection of the official publications on the construction, operation and maintenance of aircraft instruments originally printed in pamphlet form by His Brittanic Majesty's Stationary Office. The book contains a general introduction to the tools and techniques of instrument handling, followed by operational and maintenance instructions for various types of tachometers, clocks, altimeters, compasses, computers, oxygen apparatus, etc.

Naturally, the entire text of the manual is British in its approach, indicating the many points at which American technical terminology, procedure, and in some cases tolerance and constructional theory, vary from the British.

Aviation Instrument Manual, Chemical Publishing Company, Brooklyn, N. Y., 1941; 396 pages, $5.00.

Instrument Handbook

The aeronautical engineering officer in charge of the Royal Canadian Air Force Instrument Repair Base developed this textbook to meet the requirements of the systematic course in the maintenance of aircraft instruments. The work presupposes a certain amount of technical knowledge—not so much of the instruments themselves but of general mechanical operation.

Chapter by chapter, it follows a routine procedure: an individual aircraft instrument is named, its operation and parts are explained, possible causes for failure or inaccuracy are presented; and test apparatus and directions for the location and the correction of this fault are given. Finally, directions for calibration and reinstallation are then given where necessary. This treatment is given in the account of various pressure gages and thermometers, accelerometers, mixture indicators, tachometers, manifold pressure gages, clocks, air speed indicators, altimeters, compasses and the like.

Particularly simplified details are given on the Sperry Gyro instruments and certain more complex avigational devices such as the aircraft bubble sextant. The operation of the Link trainer and its use in teaching flight technique, particularly landing systems and landing procedures, is given a considerable amount of space. General discussion follows on instrument flight training.

The entire approach of this work is intensely practical and, while it has been written by a Canadian Air Force officer, the instruments discussed and the materials used are American in their origin. In the preface the author acknowledges the aid of Lieut. Comm. P. V. H. Weems and Mr. Charles A. Zweng. Part of the material definitely bears the stamp of these two well-known avigators' influence.

Pilots' and Mechanics' Aircraft Instrument Manual, Flight Lieut. G. C. DeBaud; The Ronald Press Company, New York, 1942; 490 pages, $4.50.

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Illustrated Aviation Dictionary

A modernized and thoroughly revised aeronautical dictionary, this book contains upward of 1,500 commonly used aeronautical definitions and terms. Aerodynamics, theory of flight, design, materials, construction, rigging, welding, avigation, meteorology and many other subdivisions of the field are covered. The work contains many of the new terms which have come into use recently, particularly those concerned with structure and hydraulics. Also included are expressions which have come into being since the outbreak of war.

Noteworthy in this dictionary is the fact that the publishers resisted the temptation to use prominently the threadbare N.A.C.A. illustrations. They are instead relegated to the back of the book where they are used to show the parts and indicate obsolete terms applied to older aircraft.

Simplified Definitions and Nomenclature for Aeronautics, by Lieut. Leslie Thorpe; illustrated edition, Aviation Press, San Francisco, 1942; 196 pages, $2.00.

Adventure in Finland

The experiences of a test pilot for the Brewster Aeronautical Corporation during the spring and summer of 1940 form the basis of this narrative. The author, a former Navy flyer, went to Sweden to test-fly a group of Brewster fighters consigned to the Finnish Air Forces and to teach the Finnish combat pilots how to fly the American planes.

The adventure includes being inspected at Kirkwall en route to Norway, leaving with the Finnish and Lap pilots while they checked out on the new type aircraft going to Finland, and getting back to the United States via Germany, Italy, France, Spain and Portugal. On the eventful trip home, the author witnessed the bombing of Paris, the evacuation of Bordeaux and finally the collapse of France. With a beautiful golden-haired girl as genuine heart interest, and the heartbreak of the Russo-Finnish armistice as high point. this adventure rivals the best fiction of this period for excitement and for color.

The author, who worked for five years on the *New York Times* and the New York *Daily News*, before entering the Navy as an aviation cadet, writes with the same fluency as he flies. He is now back in the Navy as a flying instructor.

Aces Wild, by Lieut. Robert A. Winston; Holiday House, New York, 1941; 320 pages, $2.50.

Materials Text

This standard college textbook was originally written to furnish a concise presentation of the physical properties of the common materials used in structures and machines, together with brief descriptions of their manufacture and fabrication.

The current revision is the sixth edition, containing a chapter on plastics and incorporating rather extensive changes in the chapters on the failure of materials by creep or flow, on the failure of materials by fracture, on the crystalline structure of metals, in the tables of strength and ductility properties of ferrous and of non-ferrous metals, in the chapter on concrete, and in the chapter on testing, inspection, and testing machines.

The section on rubber, rubberlike materials, leather, belting and rope has new matter on rubberlike materials. The illustrative specifications in the chapter on specifications for materials have been revised to conform with the latest standards of the American Society for Testing Materials.

Textbook of the Materials of Engineering, by Herbert F. Moore; McGraw-Hill Book Company, Inc., New York, 1941; 454 pages, $4.00.

Book Notes

Civilians Must Fight, by Raymond Daniell; Introduction by W. Somerset Maugham; Doubleday, Doran & Co., Inc., Garden City, New York, 1941; 322 pages, $2.50.

Another study of what has kept England in motion in spite of the staggering blows dealt from the air, this account cites the tribulations of the civilian populace under air attack and the courageous spirit which defies this phase of modern warfare.

The Air Raid Safety Manual, by Captain Burr Leyson; E. P. Dutton and Company, New York, 1942; 94 pages, $1.00.

A brief, simplified compendium of information required for the protection of civilians during air attack on communities.

Plastics, by V. E. Yarsley and E. G. Couzens; Penguin Books Inc., New York, 1941; 160 pages, $0.25.

A study of the nature, molding and application of plastics to modern industry, with special attention to its use in aircraft structures, accessories and transparencies.

Fourier Series and Orthogonal Polynominals, by Dunham Jackson; The Mathematical Association of America, Oberlin, Ohio, 1941; 234 pages, $2.00.

A monograph on the mathematical simplicity of the properties of orthogonal functions and the development in series associated with them.

Higher Mathematics for Engineers and Physicists, by Ivan S. Sokolnikoff and Elizabeth S. Sokolnikoff; 2nd edition, McGraw-Hill Book Company, New York, 1941; 587 pages, $4.00.

An introduction to those branches of mathematics frequently encountered by the engineer in his practice and by the research specialist in the applied sciences.

Automatic Arms, by Melvin M. Johnson and Charles T. Haven; William Morrow and Company, New York, 1941; 344 pages, $4.50.

A comprehensive treatment of the history, operation and application of automatic fire arms as applied to modern warfare. This work outlines the background of multifiring weapons and gives detailed explanation on their operation and employment in combat.

First Principles of Flight, by D. Hay Surgeoner; Longmans, Green and Company, New York, 1941; 108 pages, $1.25.

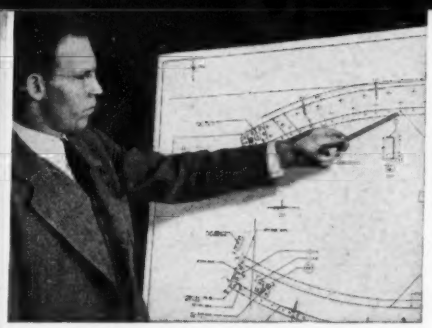
An introduction to basic aerodynamics written to give students a syllabus through which they can acquire the basic knowledge required for flight and flight study.

Conversational Spanish for Army Air Forces of the United States, by Solomon Lipp and Henry V. Besso; Hastings House, New York, 1941; 168 pages, $0.75.

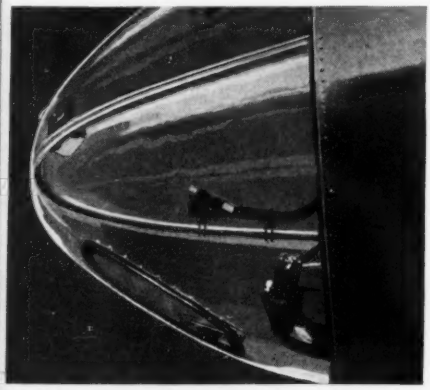
A basic manual of the Spanish language, compiled particularly for members of the Army Air Force who may be stationed in Latin America. Special emphasis is laid on technical terminology and words most frequently used by flying personnel.

Wings for America, by Thomas Penfield; Rand McNally & Company, Chicago, 1941; 64 pages, $0.10.

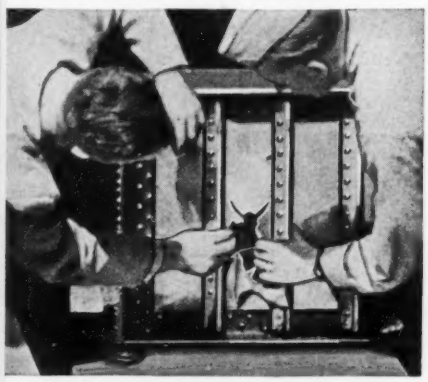
A brief history and description of the United States aircraft in current use, their application in modern warfare and the preliminary principles of air operation. Written for a junior audience.



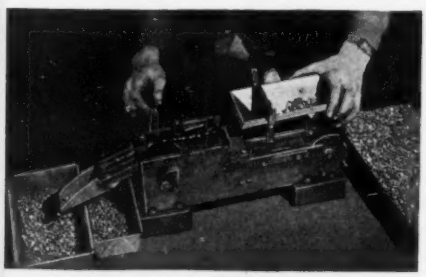
Robot Draughtsmen were Martin's solution when expansion made a shortage of engineers inevitable. Now Martin's giant photo-layout method reproduces drawings in full scale directly on sheet metal, eliminates layout time, makes available hundreds of engineers for more important work.



Plastic Pioneering Paid Off—when aluminum became critically scarce in 1940. Winner of the 1940-41 Modern Plastics Award, Martin now uses plastics in place of aluminum for 400 different aircraft parts. Pictured is the business end of a Martin B-26—made of tough, light-weight plastic.



A 1940 General Arnold "Must"—self-sealing fuel tanks. Martin—with the Mareng self-sealing tank—was first to answer. Riddled by machine gun fire, the Mareng tank remains leak-proof—is now standard equipment on many American warplanes.



ron Fingers Supplant Hands in sorting the housands of rivets swept up from Martin floors ach day. This rivet sorter is just one of scores of ninor labor-saving devices developed by Martin—o save precious man hours that will help reduce he duration of war.

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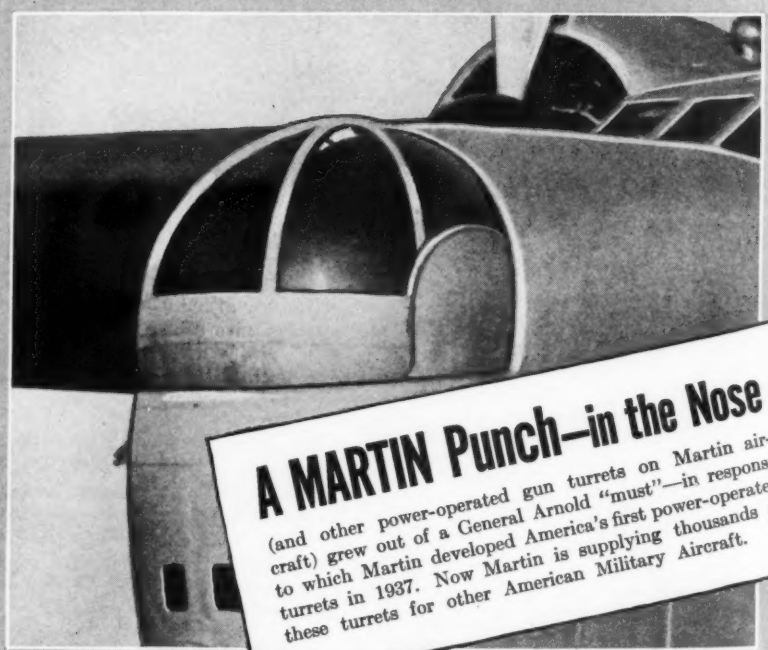

A MARTIN Punch—in the Nose

(and other power-operated gun turrets on Martin aircraft) grew out of a General Arnold "must"—in response to which Martin developed America's first power-operated turrets in 1937. Now Martin is supplying thousands of these turrets for other American Military Aircraft.

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Helicopter Improvements

Changes Improve Stability and Control of VS-300 Helicopter. A brief description of some of the structural changes incorporated in the Sikorsky VS-300 Helicopter. These include elimination of some of the outriggers and certain propeller changes as well as the addition of a closed fuselage giving the Helicopter smoother external lines. *The Bee-Hive*, December.

Air Freight's Future

Transportation's Upper Level. C. Bedell Monro. The president of Pennsylvania-Central Airlines presents a current and future picture of the nation's air transport system, indicating how the current military situation affects both personnel and equipment, and how the increased dependance on air freight as a carrier of materials is altering the future design and operational philosophy of the nation's air transport systems. *Steel Horizons*, Volume 3, Number 6.

Symbols for Drawing

Graphical Symbols. The committee on the standardization of graphical symbols and abbreviations of the American Society of Mechanical Engineers has issued a compendium on graphical symbols for use in mechanical drawings. Although the greater part of the book is devoted to symbols for plumbing, construction and general building work, the standardized symbols given for riveting and welding are those applied to aircraft construction. *American Standards Association.*

Winter Operation

Tips on Cold Weather Operation. W. E. Catton. The superintendent of Canadian Airways, Ltd., offers some of the general rules evolved by the "Bush pilots" of Canada for satisfactory operation in cold weather. The systems of oil dilution, heating and priming which make operation in Canada's sub-zero conditions possible are simplified for use by private flyers. *A.O.P.A. Section*, January.

Performance Recorder

A folder describing the Redhed flight analyzer, an instrument designed to measure and record the performance of both the airplane and the pilot, has been issued recently by the *Impact Register Company* of Champaign, Illinois. The instrument records on a wax-coated chart the acceleration, pitch and attitude of the aircraft, simultaneously with the action of the controls, thus recording the actions of the airplane and the pilot over any given flight period.

Parachutes and Parachuting

The Interesting Story of Parachutes. Captain Roger Don Rae. A brief history of parachuting from LeNormand and Garnerin to the present day, this 32-page booklet explains the development of the parachute, indicating its uses as an aircraft safety device and more recently as a military weapon. Details are given on the construction and operation of the parachute and the training of parachute jumpers. *Reliance Manufacturing Company.*

Glider History

New Wings for War and Peace. In the light of the increasing military importance of gliders, this article reminisces on the transcontinental glider flight of the late Capt. Frank M. Hawks who piloted his glider in a towed flight from San Diego, California, to Van Cortlandt Park in New York City in 36 hours, 47 minutes. Details of this flight are recalled. Some of the many uses to which gliders can be put in modern military operation are noted. *The Texaco Star*, January.

Vultee History

Vultee's V's for Victory. H. F. Brown. This article gives an account of the growth of Vultee Aircraft, Inc., and describes the type of airplanes being built at the various plants of this expanded company. Details are given on the company's system of power driven production lines. *Shell Progress*, January.

Tube Shaping

Tube Benders. An explanation, aided by illustrations, of the method used by Bell Aircraft for bending tubes. The process calls for a "mock-up" tube made out of flexible material, followed by a full scale layout on paper before the material is finally placed into the bending machine. *The Bellringer*, January.

Aircraft Antennae

De Luxe Antenna System. Additional leaves to an existing loose-leaf catalogue on R.C.A. radio products, this folder contains descriptions of improved aircraft transmitting and receiving antennae. The AVA-41A antenna system, a retractable trailing wire type designed for transmitters of 50 watts or less, and the AVA-122 loop antenna for direction finding are described. *R.C.A. Manufacturing Company.*

Brewster Production

A pamphlet on the various types of aircraft and aircraft subassemblies built by *Brewster Aeronautical Corporation* in plants at Newark, Long Island City, and Johnsville, Pennsylvania.

Alloy Conservation

Pluramelt Conserves Vital Alloys. A leaflet outlining a plan for conserving stainless steel by coating plain steel with a single or double armor of stainless material making possible the saving of 80 per cent of the scarcer alloy and producing the same amount of surface protection. The booklet explains the product and indicates its availability and use in conserving strategic alloys and armoring equipment against chemical and atmospheric corrosion, high temperature oxidation, abrasion and impact. *Allegheny Ludlum Steel Corporation.*

New Assembly System

"Vertical" Assembly Line. An explanation of the newly installed "vertical" assembly line used at the El Segundo division of Douglas for the production of A-20B nose sections. The new assembly system has the general characteristics of a horizontal assembly line, but at the same time is accessible from all sides, as well as the top and bottom.

This type of assembly offers such advantages as permitting the entire unit to remain in the position in which it would finally be installed, makes it accessible from all directions except the rear, which is normally closed off by structures, is a convenient working height from the floor and yet has sufficient clearance to avoid obstruction by benches, ladders, etc. *Douglas Airview*, December.

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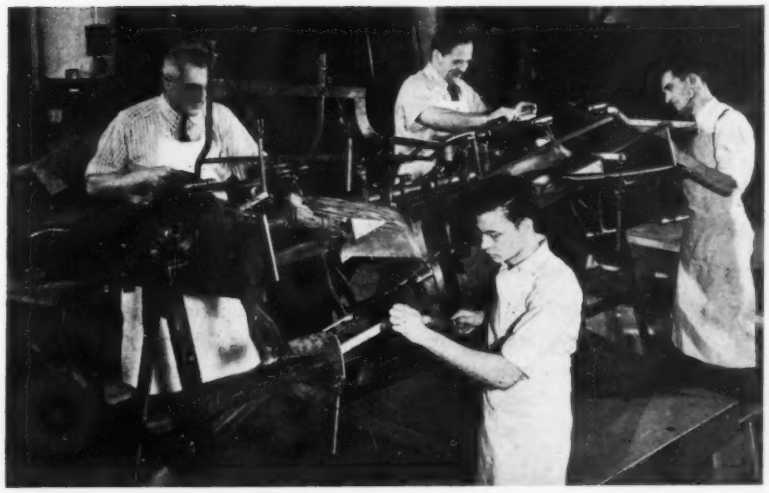


Automobile jig builders at the Fisher Body Plant assemble nacelle fillet jigs for the B-25 twin-engined bomber.

Portable Landing Fields

Portable Air Field for Uncle Sam. A description of the Greulich system of portable landing fields, which has been characterized by Maj. Gen. Arnold as one of the year's major achievements. The system was invented by G. G. Greulich, a sales representative of the Carnegie-Illinois Steel Corp. It consists of interlocking strips of perforated steel. In recent test conducted during maneuvers, the material demonstrated that it could be instrumental in establishing serviceable runways in a very short time. *U.S. Steel News*, January.

Engine History

Earliest of the Radials. Harold W. Craver. A technical discussion of the father of all radials, the five-cylinder 52 hp. engine which was used in the Langley Aerodrome and was the true predecessor of the present-day radial engine. The article offers a history of the powerplant's predecessors and describes the construction and operation of this first radial which powered Dr. Langley's *Aerodrome*. *Trade Winds*, December.

Resinous Surfaces

A general discussion of Bakelite synthetic resins as applied in paints and varnishes is given in a small booklet discussing the history of Bakelite finishes and their many uses as aircraft finishes for surface protection against weather and abrasion. *Bakelite Corporation.*

Bearing Catalogue

Die List 18. A new die list tabulating the inside and outside dimensions of "Compo" oil retaining porous bronze bearings gives the availability of various lengths below and up to maximum lengths specified in each instance without special dies. The list also includes illustrations of self-aligning bearings and special shapes such as gears, sprockets and other unusual shapes indicating the broad adaptability of porous bronze material and other than standard shapes. *Bound Brook Oil-less Bearing Company.*

New Navy Blimps

Wright Power for the "K's." A history of progress in the design of non-rigid aircraft from the World War I types which were used in conjunction with destroyers for convoy duty to the latest K series, powered by two 450 hp. Whirlwind engines. These blimps are a city block long, four stories high and can cruise 1200 miles without refueling. *Trade Winds*, December.

Engine X-Rays

Overtime Worker. A study of the application of the X-ograph, or X-ray pictures, to the detection of hidden flaws and faults in engine parts manufactured at the Wright Aeronautical plants. Descriptive details are given on the technique and equipment used and the system by which the X-ray information is collected, recorded and applied. *Trade Winds*, December.

Night Fighting

Havoc Over France. Carl Olsson. An R.A.F. Squadron Leader relates his experiences on fighter-bomber flights over France at night in the Douglas Havocs. This aircraft, a conversion of the DB-7 type purchased by the French Government and taken over by the R.A.F. after France's capitulation, is used for sweeps over France.

They take off when the enemy raid starts, and harry him coming and going, bomb his airfields and keep his flare path extinguished to prevent his landing safely if he comes home damaged. The article describes operating conditions in the Havoc and relates actual experiences during these night raids over enemy territory. *Douglas Airview*, December.

Fawcett History

Enterprise. A brief history and operations story of the Fawcett Aviation Company of Peru, which was founded in 1928 to fly a 1400-mile transport system over difficult topography and over mountain peaks more than 19,000 feet high. The line, which not only handles passengers but hauls freight and even live stock, has proved highly successful, having flown under these difficult operational conditions in aircraft built by the line itself to suit its particular needs. *The Goodyear News*, December.

Symbols and Statistics

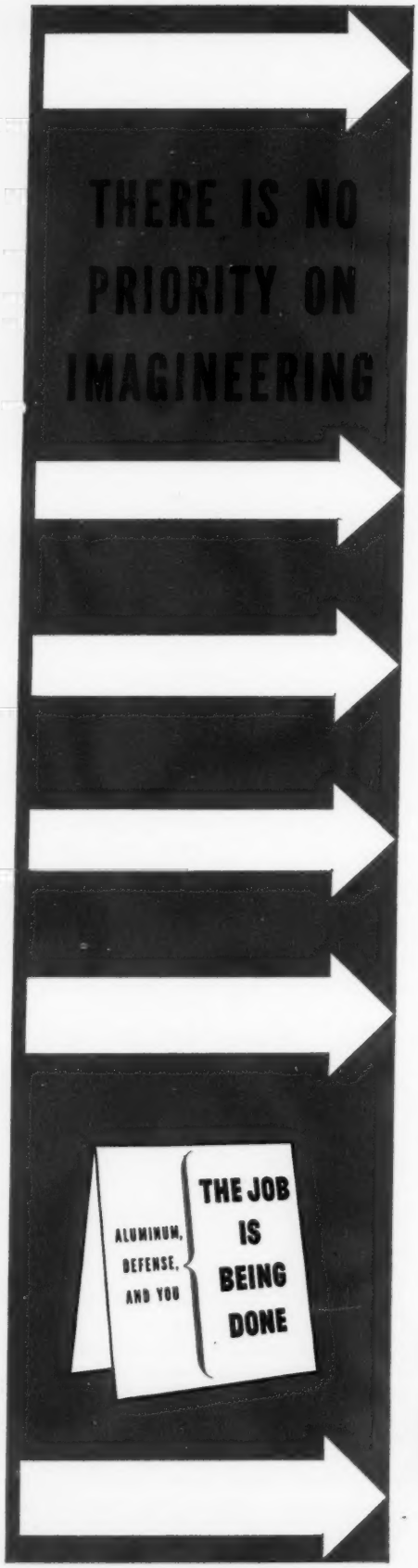
Pratt and Whitney Aircraft has issued a new pocket handbook of aircraft symbols and statistics in common use by aeronautical engineers and other aircraft workers. The material contained in this handbook includes general aeronautical symbols; aerodynamic coefficients; tables of approximate aerodynamic relationships; international standards, engine power equations; the weights of liquids, gases and materials; general facts on lubricating oils; drill sizes; color codes for piping; aircraft dimensions and general figures in common use.

Cable Strain Reliefs

A leaflet describes three types of Gripmaster strain reliefs used where electric cables are employed to link an electrical device with the power source by anchoring the chord to the product housing at the point of strain. These reliefs prevent the loosening of terminals through pull and twist and protect the chord at the point where many electrical failures occur. *George Walker Company.*

Instrument Shops

They've Got the Hookups. A survey on the manner in which the unusual skills and talents required in the accessory, instrument and radio shops of Boeing Aircraft are gathered. According to the article, the foremen of the shops have recruited such experts as watchmakers, former physics instructors, amateur radio operators, glassblowers, lapidaries, inventors and electricians to meet the constantly altering problems which come up in these interlocking departments of a modern wartime aircraft factory. *Boeing News*, December.



EVERY INDUSTRY, every responsible man in industry, has the present duty of answering two questions.

FIRST ONE IS: Are we, am I personally, doing everything within my power for the war? Our answer here at Alcoa is a plain, unqualified, yes.

NEXT QUESTION IS: What are we doing about the day when we will all need business, which is the polite way of saying, when millions of jobs will be needed for the boys who come back, and for the boys who stayed back to make the weapons.

IMAGINEERING, you know, is the word we have coined to define what we business people have all got to do about the future; about the products we are going to make and the services we are going to be able to offer when this war is over. Imagineering is imagination plus engineering.

HOW DO YOU DO IT? One way would be to figure out, now, how to take advantage of all the aluminum that is going to be available.

QUICKEST WAY TO GET AT IT is to take one of your products or a piece of equipment that "just couldn't" be made of aluminum, and ask yourself, Why not?

MEANING, OF COURSE, why not light; why not stronger for the same weight; why not resistant to corrosion, and so on, ad infinitum. The first man in any line of business who calls tradition a liar, and things-as-they-are a millstone, is the man who is going places; the man who is going to make peacetime pay rolls.

THAT'S IMAGINEERING AT WORK. We've got some ideas here at Alcoa. We're trying to pass them out. We are looking for men who have made themselves receptive by doing some solid Imagineering on their own hook, in their own fields.

Aluminum Company of America, 2142 Gulf Building, Pittsburgh, Pennsylvania.

ALCOA ALUMINUM

From the Industry

Releases are edited as received from companies and other aeronautical organizations and the responsibility for the accuracy of all statements is therefore not assured by the Aeronautical Review.

U.S. Army Air Forces

Revision of Aviation Cadet requirements for bombardiers, navigators, pilots and ground officers in the Army Air Corps through reduction of the age limit to 18 years, institution of a uniform simplified test in place of the previously required written examination or college credits, and extension of eligibility to married men, was announced recently by the War Department. A revision already in effect is the extension of eligibility to married men; it applies to candidates for cadet, air crew and ground course training.

Through the wide revisions in requirements, approximately 2,000,000 more men are expected to become eligible for enlistment in the Army Air Corps. Immediate enlistment and appointment as an Aviation Cadet is possible under a revision of procedure and the establishment of an increased number of Cadet Examining Boards in each of the nine Corps Areas in the U.S.

A new "screening test" is to be given to all applicants for air crew training as bombardiers, navigators and pilots. There will be no exemptions because of college credits earned. The test, in which the applicant will choose the correct answer from five possible answers given for each question, is designed to determine the applicant's fitness to pursue successfully the courses of instruction in Air Corps training schools.

The new tests do not emphasize detailed academic knowledge or studies but are concerned with an applicant's proficiency and ability to comprehend subjects with which he will be confronted in the training texts and manuals. The scope of the test is designed to determine the applicant's mechanical comprehension and his ability to understand mechanical apparatus and diagrams, his alertness to new developments in science aviation and military affairs and his judgment in practical situations.

Applicants for Aviation Cadet instruction in ground courses of training, however, must meet definite educational requirements, although the physical requirements for this type of duty do not include passing the flight physical examination.

Eligibility for armament training is extended to civilians, former Aviation Cadets now in civil life and to Aviation Cadets currently undergoing instruction, and preferably to men who have had training in engineering or science. Aviation Cadets and former cadets must be recommended by the commanding officer of the Air Corps Training Detachment for such training by reason of mechanical aptitude, and may not have failed in any ground school subject.

Candidates for engineering training must have completed at least three years of engineering studies at an accredited college or university. For communications training, candidates must have completed either two full years of engineering studies or have had two years of college and hold an amateur radio license.

Applicants for meteorological training must be college graduates, or completing their senior year in college, and have specialized in sciences, engineering or similar technical subjects. They must have satisfactorily completed thorough courses in mathematics, including differential and integral calculus, and physics, including heat and thermal dynamics. Applications for photographic training are not being accepted at present, but applicants must have at least three years of chemistry or geology in an accredited college, and preferably have professional or considerable amateur experience.

Civil Aeronautics Administration

Pilot-mechanics for light airplanes to be used in artillery observation are being trained by the Field Artillery and the C.A.A. in an experimental program which started at Fort Sill, Oklahoma, on January 13. The school is using Air Corps light airplanes featured in Army maneuvers last summer. The first class consists of a group of Field Artillery officers and enlisted men, 90 per cent of whom are graduates of recent C.A.A. pilot training courses.

The training is a cooperative venture between government and civilian agencies. There are six civilian instructors in flying and ground school subjects, including four selected by the C.A.A. from pilot-training schools and two who took part in the Army maneuvers last year in connection with the light airplane tests. Richard Alley, Assistant Chief of the Flight Section of the C.A.A. Pilot Training Program, and Stanley Stelle, Assistant Chief of the Maintenance Section, will supervise and assist in preparation of special texts on flying and ground school subjects. In addition, the Piper Aircraft Company has contributed the services of one man to teach airplane maintenance, and the Continental Engine Company has contributed an engine expert as instructor.

These airplanes are to be used as elevated and movable observation stations. Carrying a pilot and observer, they will operate in the air approximately above artillery positions from which vantage point the observer will be able to adjust artillery fire. Both pilot-mechanic and observer will have training in field artillery.

These airplanes must take off and land from all sorts of terrain, and the pilot-mechanic must be able to maintain his craft in the field just as the artilleryman takes care of his gun and motor vehicle. Average flights, it is estimated, will be from 5 to 15 minutes in duration, after which the pilot will probably have to land and hide his airplane.

The course is to last for about six weeks. It is to consist of 50 hours of flight training and 25 hours of ground study. If the success of the first class indicates expansion, some of the pilot-mechanics first trained may serve as instructors at other Field Artillery schools at Fort Bragg and Fort Roberts.

U.S. Civilian pilots who have proved their citizenship and loyalty may, beginning February 15, continue many of their pre-war flying activities under a system of controls designed to protect the nation, themselves, their airports, and their airplanes against saboteurs,

A corner of the T & W die-sinking shop—one of the biggest in the industry.

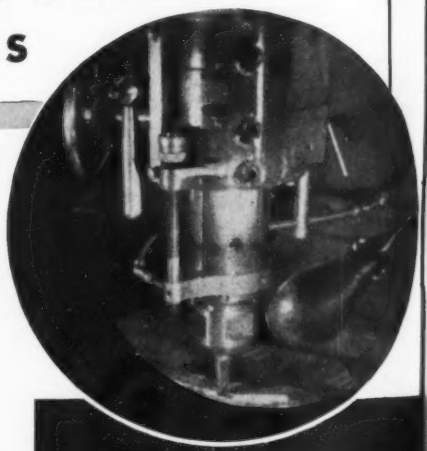
Faster Forging and Machining

DEPEND ON HOW DIE-DESIGNERS MAKE THE DIES THAT FORM THE FORGINGS

★ Skilled die-designers are the arch foes of limitations. In 60 minutes a skilled die-designer may accomplish work that will save hundreds of hours in forging and machining a quantity of forgings. Dies can be sure-fire cost-reducing tools. And, dies can be the means of saving pound upon pound of metal.

An urgent necessity in waging war is the gaining of time. Time gained in the production of such vital things as forgings for aircraft may win an earlier victory. Excess metal on forgings is of itself a costly waste, often an unnecessary waste. Machining it off adds to the cost of forgings, retards production and assembly, and postpones the day of victory. Forgings formed from T & W dies are usually formed to close tolerances. Because, T & W forgings are free of excess metal they require less time to machine and finish, and thus they have the effect of increasing the capacity of both machines and skilled men. T & W die-craftsmen are responsible for the fact that T & W forgings usually cost less at the point of assembly.

In the T & W die-sinking department dies are made for forgings weighing from one ounce up to 800 pounds by some of the most skillful die-sinkers in the forging industry. T & W forgings formed in T & W dies pass the most rigid and exacting inspections because they are of unusually sound physical structure and possess "quality advantages" beyond what the specifications call for.



FORGINGS

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and to hold their craft ready for service in any possible military emergency.

This is the summary of regulations mailed to all plane owners and airport operators in the U.S. by the Civil Aeronautics Board. The rules were worked out by the Board at the request of the War Department in cooperation with the Civil Aeronautics Administration, according to Charles I. Stanton, C.A.A. administrator.

Regulations have been prepared to eliminate confusing local restrictions, many of which have been unusually trying to civil pilots since the declaration of war. Their purpose is to tell all civil pilots what they can do, and one of the salutary effects should be a softening of the rigid restrictions on civil pilots now prevailing in certain areas of the country. Military control will be superimposed on Civil Air Regulations, in case of emergency in a given area.

In the new regulatory setup as laid down by the Board and defined by the Administration, the keymen will be a Registrar and a Clearance Officer, appointed by and responsible to the management of the airport. They must have the approval of and be designated as such by the Administration. They will be responsible for checking pilot credentials, checking the aircraft for proper registration, and issuing flight clearances. Subject to the new regulations, pilots will be free to fly as usual if the Registrar and Clearance Officers are continuously informed as to their whereabouts and activities. Local flying will be permitted in areas designated for that purpose in the vicinity of airports, and excluding areas over which local restrictions may be imposed for military reasons.

Pleasure and industrial flying may go on, in accordance with the new rules. Approval of flight plans by the Clearance Officer will permit trips beyond the local areas or to other airports. The rules for flying as set forth in the Civil Air Regulations will continue to apply as heretofore.

To prevent sabotage, 24-hour guards must be established at airports. But it is anticipated that airport personnel, working with the approval of local enforcement officials, will be able to do the job without major delay or inconveniences. Many ports will be able to carry on with present personnel, it is thought. Airport managers, mechanics, the Registrar and the Clearance Officer can conceivably do the job on a three-shift-per-day basis, once the personnel in question is properly deputized by local authorities.

On the advice of civilian pilots from widespread points, the Administration has decided that, to make an aircraft incapable of operation as required by the regulations, the aircraft must be completely dismantled and secured against unauthorized removal. The consensus was that a saboteur, once he learned whether a given pilot customarily removed his distributor, a wheel, or a propeller, could come supplied with the missing part and be in the air before anyone caught up with him if there was no guard. All airplanes will be registered under the war plan, with full details on their ownership, type, size, and the airport at which they are based, or the place of storage, thus creating a record which can be used in time of emergency.

The prime objective in forming the new regulations was to "keep 'em flying," according to the C.A.A. Administrator. "We worked on the theory that every pilot and every plane in the nation is an asset in the total war effort, and that we should make rules on the basis of what a pilot can properly do rather than what he cannot do." The Administrator has expressed his confidence that all pilots will cooperate to the fullest extent, and by so doing will materially assist in the successful prosecution of the war and minimize the necessity for more drastic regulations.

British Press Service

Composite aircraft operation may prove the answer to the Allies' problem of how to achieve greater mobility in air warfare, according to a suggestion made by Maj. Oliver Stewart, British air officer, in a recent broadcast from England. The "pick-a-back," or composite aircraft as described by him consists of two aircraft, one superimposed on the other, and both locked together. They take off as one unit, the larger machine being underneath and the smaller one, which is intended to do the job, on top.

Both machines help each other during the take-off. Each one contributes something to the lift by giving its wing surface, and to the thrust by running its engines. In this way, the upper machine can be loaded to a big weight, yet can be taken off from a small or rough airdrome. If it had to take off in the ordinary way, under its own power, it would need a bigger and better airdrome.

The main advantage of a composite launching, it was said, is that a unit is created which can operate from comparatively small and ill-prepared airdromes, and yet have with it in the larger lower components, aircraft which could do the transport work. One of the first requirements in achieving mobility for land-based aircraft is to give them sufficient power in taking off to carry their special equipment, including bomb hoists, cranes, spares, etc. It is thought that small or improvised airdromes present a problem in this regard to which composite launching may be the answer.

The mobility factor in enemy air operations was said to have played a major part in Axis strategy both in Libya and in the timing of Japan's attack in the Far East. Japan was said to have been brought into the war when German air strength was waning, to draw the Allies' air strength to the Far East and thus weaken their air position in Libya sufficiently to permit General Rommel to take the initiative.

According to Maj. Stewart, the German air force enjoys superior mobility and can therefore pin down more than its own strength in Europe and the Middle East and Russia. Neither the British nor the American air forces have the mobility, he said, necessary to allow us to reinforce our air power largely and quickly in the Pacific without dangerously weakening it elsewhere.

"Events therefore point to the need for devising means of conferring increased mobility on some sections of our air forces. Ship-borne aircraft have mobility but they cannot face land-based aircraft on equal terms, as the latter have superiority in size. The essential is to find a method of giving land-based aircraft something approaching the mobility of ship-based aircraft." Given such mobility, Maj. Stewart said, the Axis' enemies could recover their position in the Pacific, as their "aircraft engineering has proved itself superior to that of the Axis on many occasions."

Boots Aircraft Nut Corporation

Designed to cut assembly time and cost by eliminating 2 to 6 rivets on each application, the Boots self-locking multiple unit anchor nut also meets confined area applications where normal methods of riveting are impossible. To achieve this special nut assembly, the base of the sheet metal nut is cut to fit a special narrow thin gage steel channel to which the nuts are gang welded. Vibration tests justify both the effectiveness of the weld and the lock-nut in this combination.

This is a new idea and it is said to be working out successfully. In one particular airplane six different Boots *Rivet-Savers* are being jig-welded to the designers' exact requirements. This *Rivet-Saver* embodies the Boots self-locking principle, and is made entirely of sheet metal, resisting temperature and heat, saving 18 per cent to 66 per cent in weight depending upon the style and size.

Colonial Broach Company

In its program of developing broaching machines incorporating the latest improvements which facilitate production to meet increased war needs, Colonial Broach Company has announced a new standard line of dual-ram broaching machines designated as the VAD series.

WESTONS ... on every battle front

WESTON's time-honored policy of keeping constantly abreast of the instrument needs of aviation now stands our nation in good stead . . . just as it made possible the *instrument arsenal* for our present allies in their heroic struggles in the dark days past. Whether in Britain, Africa, the Middle East, or the Antipodes, planes guarding our democratic front are equipped with these time-proved, dependable instruments. And at WESTON today, the effort is *all-out* to produce the instruments vital on all new fronts of our democratic struggle. Weston Electrical Instrument Corp., 616 Frelinghuysen Avenue, Newark, New Jersey.

WESTON *Aircraft Instruments*

Electric Tachometers • Synchroscopes • Carburetor Temperature Indicators • Oil Temperature Indicators
Cylinder Temperature Indicators • Fuel-Air Ratio Indicators • Cabin and Outside Air Thermometers • Radio Compass Indicators • Blind Landing Indicators • Ammeters—Voltmeters—Volt Ammeters • Frequency Meters

The eleven sizes range from 3 tons and 36-in. stroke up to 25 tons and 66-in. stroke. The new machines feature streamlined design and increased size of the work tables and rams. Peak capacities have also been increased to provide ample reserve power when operating at normal rated capacities. The Dual-Ram machines are especially suitable where extremely high production is required and where one operator can handle feeding and removing a part from one ram while the other is on its down stroke, thus doubling output per operator.

Column widths of the new Dual-Ram machines are greater than in former types. This permits increased ram width providing better support for the wide broach bars often encountered in today's production requirements. Increased ram width also permits increasing the width of the work platen. Entirely new cylinder design is embodied, with seamless steel tubing and welded construction used for leak-proof operation. Another feature is the vertical mounting of the main drive motor within the machine, reducing the amount of floor space needed for installation.

The construction of the receding table mechanism has been improved and simplified, allowing for the installation of chip wipers to protect the bearing surfaces of the moving platen. The new design of the table provides a finish machined pad on the front for mounting auxiliary units such as cams, etc., for automatically operating clamps, locks and support jacks on fixtures. At slight extra cost provision can be made for clamping work pieces in position in a fixture by utilizing the hydraulic system of the machine. A standard Colonial feature, the patented cam lock and narrow center guide for the receding table mechanism is incorporated in the new machines.

Longer travel of the receding table has been provided in the larger machines of the new standard line. A wider range of applications with increased safety of the operator is obtained, especially with broaches having deep or irregular contours. Both the Dual Safety Control and Emergency Knee Bar (for quick stops) are supplied on all machines. Operation of the rams is continuous with one ram traveling down while the other is returning to starting position.

The automatic force feed lubrication system for the bearing surfaces of the receding table as well as the ram bearing surfaces have also been improved. A sight gage for the lubrication system is mounted on the face of the column above the platens.

Chip room and coolant capacity are increased in the new machines without increasing their overall height. All machines are equipped with heavy-duty, large volume coolant pumps.

We'ded steel construction is utilized for such parts as the column and table. The increased use of steel castings in fabrication of the machines combines the flexibility of cast design with the inherent advantages of welded construction. For greater ease in installation, all machines are equipped with crane hooks at both top and bottom.

Littelfuse, Incorporated

A tool for changing fuses in close quarters, quickly replacing a blown fuse and giving notice on inspection that another spare is required has been announced by Littelfuse, Incorporated. The tool is a spare fuse holder and puller combined. It is applicable to all 4 AG and 5 AG fuses.

The fuse in circuit goes through one end of the soft rubber rectangular Littelfuse holder, between the clips. Above, and at right angle, is an opening in the holder for the spare fuse. When inserted, the caps of the spare fuse project beyond the holder affording an easy grip for two fingers.

When the fuse in circuit blows, all the operator need do is to pull and reverse the holder. This puts the spare fuse in circuit and brings the blown fuse on top in the same position that the spare was in before. The change is speedily and easily made.

One end of the holder and puller is painted red. Until a fuse change is necessary, the red end is underneath, out of sight. When a reverse is made, putting the spare fuse in circuit, the red end is brought into full view on top. To an inspector or service man this red signal instantly indicates that a fuse has blown and that another spare is required. If the end is black, both the fuse in circuit and the spare are still serviceable.

The Glenn L. Martin Company

A second robot draftsman, able to do around three-quarters of a million man-hours of work in a single year, has been added to the engineering facilities of the Glenn L. Martin Company, according to company announcements. In the form of a giant camera, it will be teamed with the older unit of the Martin photographic reproduction process.

Because it can reproduce in four minutes drawings up to 5 × 10 ft. directly on nearly any kind of surface—metal, wood, cloth, linen paper and glass—by wiping on a secret emulsion, the photographic equipment is described as a combined engineer, tool-maker, die-maker and inspector, besides lightening the burden of workers all over the factory.

Saving untold hours of time that otherwise might be spent in redrafting, the process also has expedited shop work since reproductions on metal form the actual base of jigs and fixtures in which airplane parts are assembled. It has aided the die-makers, who may work directly from the lines on their metal, instead of laboriously scribing the patterns.

It has aided the die-casters, who no longer have to use shrink scales because the camera can enlarge the drawing just the proper amount to allow for shrinkage of the cooling metal. It has been of immeasurable value to experimental workers, who find they can cut out whole pieces of a new airplane by simply sawing along the lines photographed onto bare metal. Similarly, pieces of mock-up can be cut along lines reproduced directly on wood surfaces.

The system enables Martin engineers to work largely in full-scale drawings. It eliminates the necessity for writing in dimensions and affords a stable record for the study of contour lines, clearances and other design problems. It was to satisfy the need for lofting and, at the same time, offset its limitations that Martin engineers began to apply the photographic reproduction principle. The other advantages developed as the system was perfected.

Two rooms make up the camera itself. The bellows of the photo unit projects through the connecting wall, and a variety of lenses, the largest with a prodigious 70-in. focal length, are used. In the room before the lens, a huge copy board, suspended from an electrically-powered, remotely-controlled overhead carriage, travels back and forth according to the size of the image to be reproduced. The original drawing on coated metal is placed against the copy board and held there by strong suction through holes in the board. The negative is placed in a rack on another traveling carriage in the other room. A powerful light travels across the copy board, giving even illumination to the lines of the drawing.

The exposed negative is developed and then replaced in the rack, while the original drawing is removed from the copy board and is replaced by a sensitized sheet of coated metal in exactly the same position. Another powerful mercury vapor light, placed on the traveling carriage behind the negative, then projects the image back through the camera onto the sensitized sheet. For the largest layouts, all of the two rooms become the camera itself.

The exposed sheet then is developed by progressive immersion in four enormous stainless-steel tanks, each containing 100 gallons of liquid. With its developer, short stop, hypo and running-water wash, the process is like that of any photographic dark-room, but on a great scale.

Slots and Flaps

A bibliography giving references for research in this specialized field. Revised and brought up-to-date from the fifty volume Bibliography of Aeronautics compiled and published with the cooperation of the Work Projects Administration from the Aeronautical Index of the I.Ae.S.

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Pump Engineering Service Corporation

ENGINES

Allison Division, General Motors Corp.
Eclipse Aviation Division, Bendix Aviation Corporation
Guiberson Diesel Engine Company
Jacobs Aircraft Engine Company
Packard Motor Car Company
Pratt & Whitney Aircraft Division, United Aircraft Corporation
Ranger Aircraft Engines Division, Fairchild Engine and Airplane Corporation
Warner Aircraft Corporation
Wright Aeronautical Corporation

FABRICS

Wellington Sears Company

FASTENERS

Boots Aircraft Nut Corporation
Eaton Manufacturing Company
Simmonds Aerocessories, Inc.
Thompson Products, Inc.
Tinnerman Products, Inc.
United Carr Fastener Corporation

FITTINGS (STRUCTURAL)

Edward G. Budd Manufacturing Company
Fleetwings, Inc.
Vega Airplane Company

FINANCIAL SERVICES

The Chase National Bank of the City of New York
The National City Bank of New York

FLOATS & SKIS

Edo Aircraft Corporation
Goodyear Tire & Rubber Company, Inc.

FLOORING

Simmonds Aerocessories, Inc.

FORGINGS

Edward G. Budd Manufacturing Company
Thompson Products, Inc.
Wyman-Gordon Company

FUEL & HYDRAULIC SYSTEMS

Aircraft Accessories Corporation
American Bosch Corporation
Bendix Aviation Ltd.
Bendix Products Division, Bendix Aviation Corporation
Chandler-Evans Corporation
Eclipse Aviation Division, Bendix Aviation Corporation
Fleetwings, Inc.
Pump Engineering Service Corporation
Simmonds Aerocessories, Inc.

FUELS & OILS

The Pure Oil Company
Shell Oil Company
Socony-Vacuum Oil Company
Standard Oil Company of California
Standard Oil Company (Indiana)
Standard Oil Company of New Jersey
The Texas Company

FUSES

Littelfuse Incorporated

GEAR BOXES (ACCESSORY DRIVE)

Eclipse Aviation Division, Bendix Aviation Corporation
Pump Engineering Service Corporation

GENERATORS

Eclipse Aviation Division, Bendix Aviation Corporation
Westinghouse Electric & Manufacturing Company

HOSE (RUBBER)

Aeroquip Corp.
Firestone Aviation Products Company
The B. F. Goodrich Company
Goodyear Tire and Rubber Company, Inc.

HOSE CLAMPS

Breeze Corporations
Wittek Manufacturing Company

INSTRUCTION

Boeing School of Aeronautics
Casey Jones School of Aeronautics

INSTRUMENTS (AIRCRAFT)

Breeze Corporations
Fairchild Aviation Corporation
W. & L. E. Gurley
Kollsman Instrument Division, Square D Company
Pioneer Instrument Division, Bendix Aviation Corporation
Simmonds Aerocessories, Inc.
Sperry Gyroscope Company
Westinghouse Electric and Manufacturing Company
Weston Electrical Instrument Company

INSTRUMENTS (ENGINE)

Breeze Corporations
Eclipse Aviation Division, Bendix Aviation Corporation
Kollsman Instrument Division, Square D Company
Pioneer Instrument Division, Bendix Aviation Corporation
Simmonds Aerocessories, Inc.
Weston Electrical Instrument Company

INSTRUMENTS (METEOROLOGICAL)

Julien P. Friez & Sons Division, Bendix Aviation Corporation
W. & L. E. Gurley
Kollsman Instrument Division, Square D Company
Simmonds Aerocessories, Inc.

INSURANCE

Associated Aviation Underwriters
Aero Insurance Underwriters
United States Aviation Underwriters

LANDING GEAR

Bendix Products Division, Bendix Aviation Corporation
Cleveland Pneumatic Tool Company
Thompson Products, Inc.

LIGHTS & ACCESSORIES (AIRPORT, AIRWAY)

American Bosch Corporation
Westinghouse Electric and Manufacturing Company

MAGNETOS

American Bosch Corporation
Scintilla Magneto Company

MANIFOLDS (EXHAUST)

Airplane Division (Buffalo Plants), Curtiss-Wright Corporation
Edward G. Budd Manufacturing Company
Vega Airplane Company

METALS (STRUCTURAL)

Aluminum Company of America
American Rolling Mill Company
Climax-Molybdenum Company
Summerill Tubing Company
United Carr Fastener Corporation

MOLYBDENUM ALLOY

Climax Molybdenum Company

NAVIGATIONAL EQUIPMENT

Fairchild Aviation Corporation
W. & L. E. Gurley
Pan American Navigation Service
Pioneer Instrument Division, Bendix Aviation Corporation
Simmonds Aerocessories, Inc.

NICKEL & NICKEL ALLOYS

International Nickel Company

OXYGEN EQUIPMENT

Pioneer Instrument Division, Bendix Aviation Corporation

PISTON RINGS

Thompson Products, Inc.

PLASTICS

Bakelite Corporation
Duramold Aircraft Corporation
Firestone Aviation Products Company
United Carr Fastener Corporation
Westinghouse Electric and Manufacturing Company

PLYWOOD

Duramold Aircraft Corporation

PROPELLERS

Eaton Manufacturing Company
Hamilton Standard Propellers Division, United Aircraft Corporation
Propeller Division, Curtiss-Wright Corporation

PROPELLER PARTS

Eaton Manufacturing Company
Eclipse Aviation Division, Bendix Aviation Corporation
Hamilton Standard Propellers Division, United Aircraft Corporation
Lycoming Division, Aviation Manufacturing Corporation
Propeller Division, Curtiss-Wright Corporation
Thompson Products, Inc.

PROPELLER PRODUCTION MACHINERY

Engineering and Research Corporation

PUMPS (AIR, FUEL, OIL, VACUUM, HYDRAULIC)

American Bosch Corporation
Eclipse Aviation Division, Bendix Aviation Corporation
Chandler-Evans Corporation
Dowty Equipment Corporation
Fleetwings, Inc.
Pump Engineering Service Corporation
Thompson Products, Inc.

RADIOS (AIRCRAFT & AIRPORT)

Aircraft Radio Corporation
Bendix Aviation Ltd.
Bendix Radio Corporation
Fairchild Aviation Corporation
RCA Manufacturing Company
Sperry Gyroscope Company
Washington Institute of Technology
Westinghouse Electric and Manufacturing Company

REMOTE CONTROL & RECORDING DEVICES

Breeze Corporations
Eclipse Aviation Division, Bendix Aviation Corporation
Fairchild Aviation Corporation
Pioneer Instrument Division, Bendix Aviation Corporation
Simmonds Aerocessories, Inc.
Westinghouse Electric and Manufacturing Company

RIVETS

Aluminum Company of America
The B. F. Goodrich Company

RUBBER PRODUCTS

Firestone Aviation Products Company
General Tire & Rubber Company
The B. F. Goodrich Company
Goodyear Tire & Rubber Company

SCREWS, NUTS & BOLTS

Boots Aircraft Nut Corporation
Continental Screw Company
Eaton Manufacturing Company
National Screw and Manufacturing Company
Thompson Products, Inc.
Tinnerman Products, Inc.
United Carr Fastener Corporation

SEATS (PILOT)

Bendix Products Division, Bendix Aviation Corporation
Edward G. Budd Manufacturing Company
Firestone Aviation Products Company
The B. F. Goodrich Company

SELF SEALING COUPLINGS

Aeroquip Corp.

SPARK PLUGS

The BG Corporation
Scintilla Magneto Company
Simmonds Aerocessories, Inc.

STAINLESS STEEL

American Rolling Mill Company
Breeze Corporations
Edward G. Budd Manufacturing Company
Summerill Tubing Company

STAMPINGS (METAL)

Edward G. Budd Manufacturing Company
Eaton Manufacturing Company
Firestone Aviation Products Company
Fleetwings, Inc.

STANDARD PRECISION WEIGHTS & MEASURES

W. & L. E. Gurley

STARTERS

Breeze Corporations
Eclipse Aviation Division, Bendix Aviation Corporation

STRAINERS

Michigan Wire Cloth Company

STRUTS & SHOCK CORD

Bendix Products Division, Bendix Aviation Corporation
Cleveland Pneumatic Tool Company
Dowty Equipment Corporation
Firestone Aviation Products Company
Warner Aircraft Corporation

SURVEYS (AERIAL)

Fairchild Aerial Surveys, Inc.

SURFACES (WING & CONTROL)

Edward G. Budd Manufacturing Company
Firestone Aviation Products Company
Fleetwings, Inc.
Goodyear Aircraft Corporation

SWITCHES

Breeze Corporations
Eclipse Aviation Division, Bendix Aviation Corporation
Westinghouse Electric and Manufacturing Company

TACHOMETERS

Kollsman Instrument Division, Square D Company
Pioneer Instrument Division, Bendix Aviation Corporation
Weston Electrical Instrument Company

TIE RODS

Breeze Corporations
Edward G. Budd Manufacturing Company
Thompson Products, Inc.

TIRES & TUBES

Firestone Aviation Products Company
General Tire & Rubber Company
The B. F. Goodrich Company
Goodyear Tire & Rubber Company

TOOLS

Cleveland Pneumatic Tool Company

TUBING (FLEXIBLE)

Aeroquip Corporation
Breeze Corporations
Eclipse Aviation Division, Bendix Aviation Corporation

TUBING (RIGID NON-FERROUS)

Aluminum Company of America

TUBING (RUBBER)

Aeroquip Corporation
Firestone Aviation Products Company
General Tire & Rubber Company
The B. F. Goodrich Company

TUBING (STAINLESS STEEL)

Summerill Tubing Company

TUBING (STREAMLINE)

Summerill Tubing Company

VACUUM SYSTEMS

Simmonds Aerocessories, Inc.

VALVES & ACCESSORIES

Aeroquip Corporation
Cleveland Pneumatic Tool Company
Eaton Manufacturing Company
Eclipse Aviation Division, Bendix Aviation Corporation
Fleetwings, Inc.
Pump Engineering Service Corporation
Simmonds Aerocessories, Inc.
Thompson Products, Inc.
Westinghouse Electric and Manufacturing Company

WHEELS & BRAKES

Bendix Products Division, Bendix Aviation Corporation
Firestone Aviation Products Company
General Tire & Rubber Company
The B. F. Goodrich Company
Goodyear Tire & Rubber Company
Simmonds Aerocessories, Inc.
Warner Aircraft Corporation

WIRE ROPE & CABLE

John A. Roebling's Sons Company

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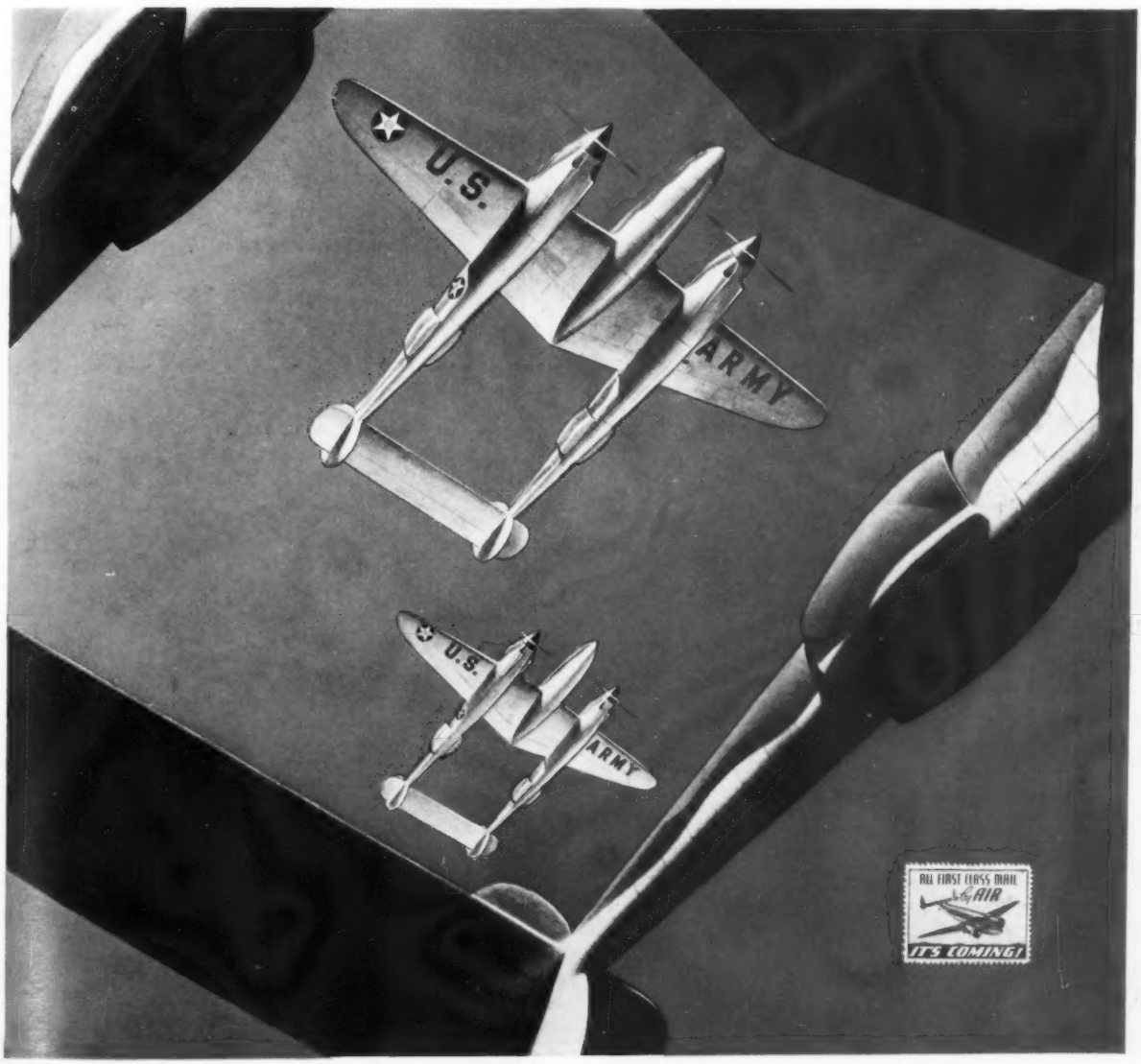

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